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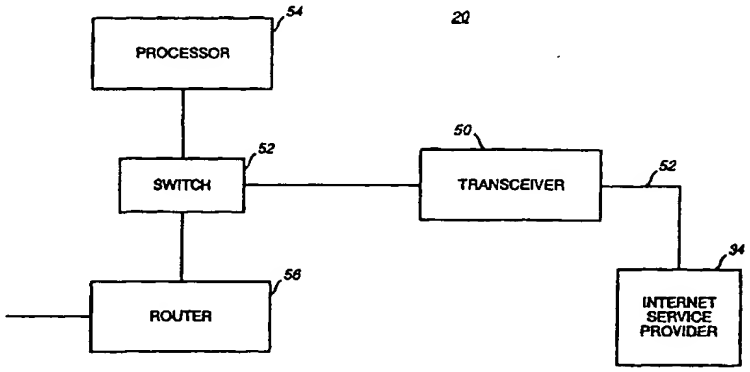

(57) Abstract

A home gateway system (20) includes a transceiver (50) connected to a switch (52). A processor (54) is connected to the switch (52) and provides intelligent functions for the switch (52). A router (56) is connected to the switch (52). The router (56) upon receiving a data packet from an internal port where the data packet has an external address, routes the data packet through the switch (52) to the processor (54). The processor (54) directs the transceiver (50) to establish a telephony connection with an internet service provider (34) and sends the data packet to the internet service provider (34).

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HOME GATEWAY SYSTEM AND METHOD

Field of the Invention

The present invention relates to the field of communication systems and more particularly to a home gateway system and method.

Background of the Invention

Home owners often have a variety of machines for receiving information services, such as a cable receiver box, several telephones, an answering machine, a caller ID box, a home Local Area Network (LAN), and a dial up connection to the internet. Each information carrier feels compelled to have their own software and hardware. Presently all these different machines operate separately and often redundantly. These information carriers are now offering each other's products. Cable television operators want to provide the home owner with telephone service, while telephone companies want to provide cable television services. Satellite television services want to offer high speed connections to the internet. The user is often overwhelmed by the multitude of choices and is not interested in learning the different

hardware and software requirements for each of these different carriers of information.

Thus there exists a need for a home gateway system that can integrate the functions of these various devices, so that a user need not concern himself with the particular carrier providing the service.

Brief Description of the Drawings

FIG. 1 is a schematic diagram of a home gateway system connected to a variety of information carriers in accordance with one embodiment of the invention;

FIG. 2 is a block diagram of a home gateway system in accordance with one embodiment of the invention;

FIG. 3 is a block diagram a home gateway system in accordance with another embodiment of the invention;

FIG. 4 is a block diagram a home gateway system in accordance with another embodiment of the invention;

FIG. 5 is a block diagram of a voice processing system used in a home gateway system in accordance with one embodiment of the invention;

FIG. 6 is a block diagram of a transceiver used in a home gateway system in accordance with the one embodiment of the invention;

FIG. 7 is a schematic diagram of a wavelength division multiplexing scheme used in a home gateway system in accordance with one embodiment of the invention;

FIG. 8 is a schematic diagram of a time division multiplexing scheme used in a home gateway system in accordance with one embodiment of the invention;

FIG. 9 is a schematic diagram of a code division multiplexing scheme used in a home gateway system in accordance with one embodiment of the invention;

FIG. 10 is a schematic diagram of a derive lines scheme used in a home gateway system in accordance with one embodiment of the invention;

FIG. 11 is a flow chart of a method of operating a home gateway system to provide a data telephony connection in accordance with one embodiment of the invention;

FIG. 12 is a flow chart of a method of operating a home gateway system to provide a data telephony connection in accordance with another embodiment of the invention;

FIG. 13 is a flow chart of a method of operating a home gateway system to provide a data telephony connection in accordance with another embodiment of the invention;

FIG. 14 is a flow chart of a method of operating a home gateway system in accordance with one embodiment of the invention;

FIG. 15 is a block diagram of a home gateway system with telephony functions in accordance with one embodiment of the invention;

FIG. 16 is a block diagram of a home gateway system with telephony functions in accordance with one embodiment of the invention;

FIG. 17 is a flow chart of a process of voice dialing used in a home gateway system in accordance with one embodiment of the invention;

FIG. 18 is a flow chart of a method of operating a home gateway system in accordance with one embodiment of the invention;

FIG. 19 is a flow chart of a method of using a derived lines procedure in a home gateway system in accordance with one embodiment of the invention;

FIG. 20 is a flow chart of a method of operating a home gateway system in accordance with one embodiment of the invention;

FIGs. 21 & 22 are flow charts of a method of operating a home gateway system in accordance with one embodiment of the invention;

FIG. 23 is a schematic diagram of a home gateway system for home automation and security in accordance with one embodiment of the invention;

FIG. 24 is a block diagram of a home gateway system for home automation and security in accordance with one embodiment of the invention;

FIG. 25 is a flow chart of the steps used in a home gateway system for home automation and security in accordance with one embodiment of the invention;

FIG. 26 is a flow chart of the steps used in a home gateway system for home automation and security in accordance with another embodiment of the invention; and

FIGs. 27 & 28 are a flow chart of the steps used in a home gateway system for home automation and security in accordance with another embodiment of the invention.

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Detailed Description of the Drawings

A home gateway system provides a way of integrating all the information carrying needs of a home owner. One embodiment of a home gateway system includes a transceiver connected to a switch. Á processor is connected to the switch and provides intelligent functions for the switch. A router is connected to the switch. The router upon receiving a data packet from an internal port with an external address, routes the data packet through the switch to the processor. The processor directs the transceiver to establish a telephony connection with an internet service provider and sends the data packet to the internet service provider. The transceiver can also be used to establish a communication channel over a wireless local loop. A voice processing and caller ID system can be connected to the processor to provide telephony answering and screening services. The home gateway system can integrate many of the functions of telephone systems, local area networks, internet dial up services, cable television services, and satellite television service.

FIG. 1 is a schematic diagram of a home gateway system 20 connected to a variety of information carriers in accordance with one embodiment of the invention. The home gateway system 20 is located inside a house 22. The home gateway system 20 has an input to receive a cable television 24 input signal. The home gateway system 20 is also connected by a wireless local loop 26 and a base station 28 to the public switch telephone network (PSTN) 30. The antenna 32 for the wireless local loop 26 is shown in the attic of the house. The PSTN 30 provides access to an

internet service provider (ISP) 34, which provides access to the internet 36. A telephone 38, television 40, computer 42 and printer 44 can all be connected to the home gateway system 20. The home gateway system 20 allows the computer 42 to talk to the printer 44 or to the ISP 34. The telephone 38 can place a standard telephone call over the PSTN 30 or place a data telephone call over the internet 36.

FIG. 2 is a block diagram of a home gateway system 20 in accordance with one embodiment of the invention. The home gateway system has a transceiver 50 capable of establishing a telephony connection 52 with an internet service provider 34. The transceiver is connected to a switch 52. The switch 52 is connected to a processor 54 and a router 56. The switch 52 in one embodiment is connected to a plurality of telephones and can provide switched connections between the plurality of telephones in the house. The router 56 can be connected to a variety of data devices such as computers, printers, scanners and facsimile machines. A data telephony connection can also be established through the router 56. In order to establish a data telephony connection, the router receives a request for internet telephone connection from an internal port. The request is routed by the router through the switch 52 to the processor 54. The processor 54 determines that the request requires establishing a session with an internet service provider 34. The processor 54 directs the transceiver 50 to establish a telephony connection with the internet service provider 34, by sending a command including the internet service providers telephone number to the transceiver 50. The processor 54 then establishes a communication session

with the internet service provider. Once the telephony connection and session are established the telephone phone proceeds normally. The voice signal is encoded into data packets for transmission over the internet. The ISP 34 upon receiving a request for a data telephony connection can route the information to an internet phone service provider. The internet phone service provider routes the call over the internet to a PSTN switch (POP point of presence) closest to the destination number. The PSTN switch routes the last part of the call in a standard manner.

The router upon receiving a data packet from an internal port with an external address, sends a request to the processor to establish communication session. The processor directs the transceiver to establish a telephony connection with an internet service provider (ISP). Once the communication session is established data packets are routed to the ISP.

FIG. 3 is a block diagram a home gateway system 20 in accordance with another embodiment of the invention. In this embodiment the transceiver 50 establishes a wireless local loop connection 60 with a base station 62. The base station 62 can route a call to an internet service provider 64. The transceiver 50 is again connected to a switch 52. The switch 52 is connected to a processor 54 and a router 56. The switch 52 also has a plurality of input lines 66. Telephones, facsimile machines and modems are among the devices that can be connected to the switch 52. The router 56 is shown with several inputs 68. The router 56 allows a user to establish a local area network within his home. The router 56 in this embodiment is connected to a television processing system 70. The television processing system 70 is able to receive

electronic messages through the router 56 and to transmit this information through a cable 72 to a channel of a television. The television processing system is also connected to an emergency broadcast system (EBS) receiver 74. The EBS receiver 74 receives emergency information and passes this information to the television processing system 70. The television processing system 70 then displays this information on a channel of a television. In one embodiment the television processing system receives an email request from a user. The user provides the request by using the remote control of the television. The television processing system then passes the request through the router and switch to the processor. The processor then directs the transceiver to setup a connection with an ISP and download the user's email. The email is then displayed on the user's television.

In one embodiment of the home gateway system 20 the switch 52 has a data telephony input as one of the plurality of inputs 66. When a user picks up a phone connected to the data telephony input and dials a destination address, the switch 52 sends a query to the processor 54. The switch 52 in one embodiment triggers based on receiving an off hook signal from the data telephony input. In another embodiment the switch 52 triggers based on receiving a destination address (e.g., telephone number or IP address). The response of the switch 52 to a trigger event is to send a query to the processor 54 asking for further processing instruction. In this case the query would include the destination address. The processor 54 then sends a response to the switch that includes an internet phone provider number. The switch then passes the internet phone provider number and the

destination address to the transceiver 50. The transceiver establishes a telephony connection with the internet phone provider 64. The processor then establishes a communication session with the internet phone provider. The interment phone provider 64 then establishes a data telephony connection over the interment to the destination address.

FIG. 4 is a block diagram a home gateway system 20 in accordance with another embodiment of the invention. A wireless transceiver 50 has an antenna 80 and is capable of establishing a wireless local loop 60 connection with a base station 62. A wireless local loop is a telephony connection between the PSTN and a subscriber's home. The wireless local loop is an alternative to a standard wired local loop connection. A single base station 62 will generally cover an entire neighborhood. In one embodiment the base station 62 to subscriber link is a point to multi-point (broadcast) link. The link from the subscriber's house to the base station 62 is a point to point link. These links are not mobile links, but geographically stable. This simplifies the processing of a wireless local loop compared to a mobile (cellular, PCS) telephone link and allows for lower cost, higher quality telephone links.

The wireless transceiver 50 is connected to a switch 52 as in the previous embodiments. The switch 52 in this case is connected to a voice bridge 80, as well as the processor 54 and the router 56. The processor 54 is connected to a smart card interface 82, a voice processing system 84 and a caller identification system 86. The router is connected to the television processing system 70 and to a home automation and security system 88.

The smart card interface 82 is used to store and download various user preferences or setups. The voice processing system 84 includes a complete voice mail system and a voice recognition and speech synthesis system. The voice processing system 84 in combination with the switch acts as an electronic receptionist for an incoming phone call. In addition, the voice processing system is used for voice activated dialing. The caller identification system logs incoming calls and is used for call screening. In one embodiment all calls not on a preferred list are routed to the voice mail of the voice processing system 84. This requires the switch 52 to query the processor 54 how to route incoming calls. The voice bridge 80 is used to setup three way calls (conference calls).

The home automation and security system 88 can send messages through the router to a computer, television processing system or have the wireless transceiver 50 place a call to emergency personnel. The smart card interface is used to setup various appliances and to turn on or off lights. A user can call in commands to the home automation and security system 88 by using the speech recognition technology of the voice processing system 84. The voiced command is recognized and converted into a data command that the home automation and security system 88 understands. In one embodiment the user's voice is authenticated by a speaker recognition system in the voice processing system 84, before a voiced command will be obeyed.

FIG. 5 is a block diagram of a voice processing system 84 used in a home gateway system in accordance with one embodiment of the invention. The voice processing system contains a speech recognition system 100, a speaker verification

system 102, a speech synthesis system 104 and a voice mail memory system 106. The control of the systems of the voice processing system 84 is performed in one embodiment by the processor 54. The processor 54 coordinates the voice system 100-106 to provide machine reception and voice mail capabilities for instance.

FIG. 6 is a block diagram of a transceiver 50 used in a home gateway system in accordance with the one embodiment of the invention. The transceiver has a duplexer 120 that isolates the incoming signals from the outgoing signals based on their frequencies. Outgoing analog voice signals are first encoded by a vocoder 122. The vocoder 122 converts the analog voice signal to a digital voice signal. Some outgoing signals will be digital signals, if for instance the user is using a digital cordless telephone in the house. Digital voice signals will generally be passed on to the multiplexer 124, however in some circumstances the digital voice signal is compressed by a data compression circuit 126. When the signal is a data signal it may also be compressed. All the outgoing signals are then multiplexed together by the multiplexer 124. The multiplexer 124 in one embodiment time division multiplexes the outgoing signals. In another embodiment the multiplexer 124 wavelength division multiplexes the outgoing signals. In another embodiment the multiplexer 124 code division multiplexes the signals. The multiplexing scheme chosen depends on the requirements of the wireless local loop. The outgoing signals are then modulated by the modulator 127. Then the outgoing signals are up converted by a carrier signal 128 at a mixer 130. A

processor 132 controls the multiplexer 124 and receives certain control information.

The incoming signals are first down converted by a local oscillator signal 134 at the mixer 136. The incoming signals are then demodulated by a demodulator 138. A demultiplexer 140 then demultiplexes the incoming signals. When the incoming signals are compressed, they are expanded by the data compression circuit 126. When a digitized voice signal needs to be converted to an analog voice signal, the vocoders 122 perform this function. The incoming signals are then passed to the switch.

FIG. 7 is a schematic diagram of a wavelength division multiplexing scheme 150 used in a home gateway system in accordance with one embodiment of the invention. The diagram shows a plurality of wavelength division multiplexed channels 152 and a control channel 154 carried by separate wavelengths (frequencies) W0 through W24 156.

FIG. 8 is a schematic diagram of a time division multiplexing scheme 160 used in a home gateway system in accordance with one embodiment of the invention. The diagram shows a plurality of time division multiplexed channels (ch0, ch1, . . .ch24) 162 carried at different time slots (T_0, T_1, . . . T_{24}).

FIG. 9 is a schematic diagram of a code division multiplexing scheme 170 used in a home gateway system in accordance with one embodiment of the invention. The diagram shows a plurality of channels 172 carried on different codes (CD0, CD1 . . . CD24) 174. The codes are used to modulate the channels and the channels can be recovered by demodulating with the appropriate

codes. Commonly the wireless local loop would have two to four voice channels and a control channel.

FIG. 10 is a schematic diagram of a derive lines scheme 180 used in a home gateway system in accordance with one embodiment of the invention. In one embodiment, the wireless local loop supports two telephone lines. When both telephone lines are in use, the derive lines technique can divide one of the lines in two and create three lines or the total bandwidth can be reallocated among the three lines. In the embodiment shown in figure 10, an up-link line 182 transmits for a time slot. The down link channel 184 also transmits for one time slot. The derive lines scheme compresses the existing signal by a factor of 1/2 and also compress the new signal by 1/2. Then the up-link time slot is divided in half, so that there is a first uplink time slot 186 and a second uplink time slot 188. The down-link time slot is also divided in half, so that there is a first down-link time slot 190 and a second down-link time slot 192. While the derived lines scheme is described in conjunction with a time division multiplexing scheme, it can also be implemented with a wavelength division multiplexing scheme or a code division multiplexing scheme.

FIG. 11 is a flow chart of a method of operating a home gateway system to provide a data telephony connection in accordance with one embodiment of the invention. The process starts, step 200, by connecting a telephone to a data telephony interface of the home gateway system at step 202. Next, a destination telephone number is dialed at step 204. A switch of the home gateway system triggers on a call request and sends a query to a processor of the home gateway system at step 206. A

reply is received from the processor that includes a telephone number of an internet service provider at step 208. At step 210 a telephony connection is established with the internet service provider. A message is sent to the internet service provider that includes the destination telephone number at step 212, which end the process at step 214.

In one embodiment the step 210 of establishing a telephony connection includes establishing a wireless local loop connection to a base station. The base station connects the call to the internet service provider.

FIG. 12 is a flow chart of a method of operating a home gateway system to provide a data telephony connection in accordance with another embodiment of the invention. The process starts, step 220, by receiving a request at step 222. When the request is received at a router and requires an external connection, the request is passed to a processor at step 224. A command is sent to a transceiver to establish an external connection at step 226. At step 228 a wireless local loop connection to a base station is established. A telephony connection to a service provider is established at step 230, ending the process at step 232.

In one embodiment the step 226 includes an asymmetrical data service indicator. In this case the transceiver establishes an asymmetrical data link (ASDL) with the base station. ASDL can be particularly advantageous when the user is surfing the World Wide Web. ASDL divides the bandwidth of a telephone line(s) into a low bandwidth channel from the home to the ISP and a high

bandwidth channel from the ISP to the home. This allows large amounts of graphical data to be downloaded to the user quickly.

In another embodiment after the telephony connection to the service provider is established, a plurality of data packets are received for transmission over the external connection. The priority of the plurality of data packets is determined. Those data packets having a high priority (high priority data packets) are sent before any low priority data packet are transmitted. In another embodiment the low priority data packets are compressed to form a plurality of compressed data packets. The compressed data packets are then multiplexed with the high priority data packet over the external connection.

In another embodiment the request is an information service provider request. The request can be for traffic, weather, travel or other information stored on a web site. The information may come from the internet or a telephone information system. The user can request this information through his television and in this case the received information is displayed on a channel of his television. The user can also request this information from his computer or his telephone and in that case the information is sent back to the device originating the request. Using the voice processing system it is possible to convert data to voice or voice to data so that any information source can be translating into the appropriate form for the requesting device.

FIG. 13 is a flow chart of a method of operating a home gateway system to provide a data telephony connection in accordance with another embodiment of the invention. The process starts, step 240, by receiving a destination number from a

data telephony interface. A telephony connection with an ISP is established at step 244. A message is then sent to the ISP that includes the destination number (DN) at step 246. An audio signal is received and digitized by the home gateway system at step 248. In one embodiment the signal is also compressed. The digitized signal is then packetized to form a plurality of outgoing packets and transmitted to the ISP at step 250. In one embodiment the packets have an associated priority and high priority packets are transmitted first. The home gateway receives incoming packets (plurality of incoming packets) at step 252. The incoming packets are converted into an incoming audio signal (digital or analog) at step 254. The incoming audio signal is sent to the telephone at step 256 which ends the process at step 258.

FIG. 14 is a flow chart of a method of operating a home gateway system in accordance with one embodiment of the invention. The operation starts, step 270, when a request is received at step 272. At step 274, it is determined if the request is for a switch 276 or a router 278. When the request is for a switch 276, it is determined if the request is for a data telephony connection at step 280. When the request is not for data telephony connection, other standard switch processing is performed at step 282. Standard switch processing can include internal routing of phone calls or routing to the voice messaging system for instance. When the request is for a data telephony connection it is established at step 284.

When a request was for a router 278, it is determined if the request requires an external connection at step 290. When the request does not require an external connection, standard routing

functions are performed at step 292. Standard routing functions include passing data between computers, computers and printers or fax machines for instance. When the request requires an external connection, it is determined if the request is for an asymmetrical data link 294, or a standard link 296 or an ISP information service 298. When the request is for an asymmetrical data link (ASDL), the transceiver establishes an ASDL link with an ISP. When the request is for a standard link, determining a priority of the data to be sent at step 300. When the priority is high, the data is sent immediately at step 302. When the priority is not high, the data is compressed at step 304. The low priority data is multiplexed with the high priority data at step 306. In another embodiment, the low priority data is stored until all the high priority data has been sent and then sending the low priority data at step 308.

FIG. 15 is a block diagram of a home gateway system 20 with telephony functions in accordance with one embodiment of the invention. In this embodiment a switch 320 is connected to an external telephony channel 322 and an internal telephony channel (plurality of internal telephone lines) 324. In one embodiment the external telephony channel 322 is an xDSL (Digital Subscriber Line) link with a central office, such as an ADSL (Asymmetrical digital Subscriber Line) Link. The xDSL link provides one or more derived digital voice channels as described in the copending application, U.S. serial No. 08/742,164, entitled "Method and Apparatus for Providing a derived Digital Telephone Voice Channel", filed on November 1, 1996, assigned to the same assignee as the present

invention and the subject matter which is incorporated herein by reference thereto. The external telephony channel 322 using the invention described in the above referenced application provides a plurality of digital derived telephone channels and a data channel of such an ADSL link. A processor 326 is connected to the switch 320. The processor (controller) 326 sends and receiving messages from the switch 320. A caller identification system 328 is connected to the processor 326. The caller identification system 328 receives an identify query from the processor 320. Once the incoming telephone call number has been identified the switch can route the call based on some predetermined criteria. For instance, calls not on a preferred list could be routed to a voice mail box. In this embodiment the home gateway system 20 can be connected to a standard telephone line.

In one embodiment, the switch 320 allows the owners to make "intercom" type calls. When an intercom call command (e.g., dialing an internal extension) is received, the calling line is connected with another internal phone line. In another embodiment the switch acts as an electronic receptionist. The caller is given a plurality of options (e.g., users' extensions) and the switch routes the incoming call to one of the plurality of internal telephone lines based on the caller response.

FIG. 3 is a block diagram of a home gateway system 20 with telephony functions in accordance with one embodiment of the invention. In this embodiment the home gateway system 20 has a transceiver 340 capable of establishing a wireless local loop connection 342. A voice processing system

344 is coupled to the transceiver 340. The voice processing system 344 is capable of storing a message from an incoming call. A caller identification processing system 346 coupled to the transceiver 340. The caller identification processing system 346 determines a telephone number of the incoming call. If the telephone number belongs to a screened group of telephone numbers, routing the incoming call to the voice processing system 344. The voice processing system 344, in one embodiment, provides a list of voice synthesized options to the caller. For instance, the voice processing system might announce the voice mail boxes for each member of the family. In one embodiment, the user may be asked to speak the name of the family member they wish to leave a message. A speech recognition unit in the voice processing system 344 then recognizes the spoken name and connects the caller with the family member's voice mail box.

In one embodiment, the home gateway system has a processor coupled to the transceiver 340. The processor determines if an incoming call is received during an existing call. When the incoming call is received during an existing call, an indicia is posted of the incoming call to a user. The indicia can be a light, or a beep over a speaker separate from the telephone line. This provides the user the functionality of call waiting without the obnoxious beep during the telephone conversation.

FIG. 17 is a flow chart of a process of voice dialing used in a home gateway system in accordance with one embodiment of the invention. The process starts, step 350, by receiving an

off-hook signal at step 352. Next, a voice command is received by the home gateway system at step 354. When the voice command of step 354 is a call request, a voiced name is received at step 356. A speech recognition process is performed on the voiced name and the recognized name is matched with an associated telephone number at step 358. At step 360 the home gateway system initiates a telephone call over a wireless local loop to the associated telephone number, which ends the process at step 362.

In another embodiment the voiced command is a voice mail request. In this case the home gateway system will play a plurality of voice mail options to the user. The user can then voice a desired choice. In this way the voice mail can be operated by voice commands entirely instead of requiring keypad entries.

In another embodiment the voiced command is an email request. In this case the voice processing system converts the titles of each of the emails in a user's mail box from text to an audio signal. Then the titles are announced to the user. The user then announces his voiced selection. The voice processing system then converts the body of the email to an audio signal and plays the email to the user. This allows the user to interact with his email in at a purely vocal level. In another embodiment the home gateway system first initiates a communication session over the wireless local loop to an email provider. The user's emails (plurality of emails) are then downloaded to the home gateway system.

In yet another embodiment the voice command is a request to forward a user's calls to a predetermined telephone number (predetermined forwarded telephone number). In this case the home gateway system requests a user voice a code. The home gateway system then performs a speaker verification on the code to verify the user's identity. When the user's identity is verified, the user is allowed to state a voiced command that forwards his call to a predetermined number. This embodiment allows a user to forward his calls using only voiced commands and verifies the user's identity for security.

In another embodiment, the home gateway system is used for conference calls. A first telephone call is established, then a conference call command is given. The command can be a flash hook, a voice command or a touch pad code on the telephone for instance. Next, a second telephone call is connected through a voice bridge. Then the first telephone call is connected through the voice bridge.

FIG. 18 is a flow chart of a method of operating a home gateway system in accordance with one embodiment of the invention. The method starts, step 380, by receiving a voiced command at step 382. Next it is determined if the voiced command is a call request at step 384. When the voiced command is the call request, a voiced name is received at step386. The voiced name is recognized by a speech recognition system and converted to an associated telephone number at step 388. A call is then placed to the associated telephone number over the wireless local loop (WLL) connection at step 390.

When the voiced command is not a call request, a speaker verification routine is performed at step 392. When the user is not verified, the user is denied access to the home gateway system's features and the process ends, step 394. In another embodiment, the user is asked to input a PIN (Personal Identification Number) when the system cannot verify their voice. When the user is verified, the user selects between the voice mail system, the email system and a forwarding request. When the user selects a forwarding request at step 396, the system receives a voiced command directing that the user's call be directed to a particular number at step 398. The home gateway system then waits for an incoming call at step 400. When an incoming call is received determine if a call foward cancel command is received. When a call forward command is not received, the call is forwarded at step 402.

When the user selects the email system at step 404, the titles of the emails are converted to an audio signal and played to the user at step 406. The user then voices a selection at step 408. The body of the selected email is then converted to an audio signal and played to the user at step 4100. In one embodiment the process then allows the user to enter another voice command.

When the user selects the voice mail system at step 412, the voice mail system then plays the options to the user. At step 414 the user states a voiced option. The option is then implemented at step 416. In one embodiment the process then allows the user to enter another voice command.

FIG. 19 is a flow chart of a method of using a derived lines procedure in a home gateway system in accordance with

one embodiment of the invention. The process starts, step 430, by receiving an off-hook signal at step 432. Next, it is determined if an external telephone line request has been received at step 434. It is only necessary to perform the derived lines process when an external telephone line request is received. Next, it is determined if all of a plurality of external telephone lines are in use at step 436. When all the external telephone lines are in use, a derived lines procedure is performed at step 438. The derived lines procedure steals bandwidth from the other lines to create another line. At step 440, the call is connected over the derived line, which ends the process at step 442.

FIG. 20 is a flow chart of a method of operating a home gateway system in accordance with one embodiment of the invention. The method starts, step 450, by receiving an incoming call at step 452. Next, a telephone number associated with the incoming call at step 454. At step 456 it is determined if the telephone number belongs to a set of preferred telephone numbers. When the telephone number does not belong to the set of preferred telephone numbers, a caller is requested to speak their name at step 458. At step 460 the spoken name is recorded. The recording of the spoken name is played, at step 462, so the user can determine whether to answer the phone, which ends the process at step 464.

FIGs. 21 & 22 are flow charts of a method of operating a home gateway system in accordance with one embodiment of the invention. The process starts, step 480, by receiving an incoming

call at step 482. At step 484 the caller ID system determines a telephone number associated with the incoming call. Next, it is determined at step 486 if the incoming telephone number is part of a set of preferred set of telephone numbers. When the incoming number is not part of the preferred set of numbers, the caller is asked to speak their name at step 488. A recording of the spoken name is made at step 490. A speech recognition process is performed at step 492. At step 494 it is determined if the spoken name belongs to a set of preferred callers (recognized name). When the spoken name does not belong to the set of preferred callers, the recording of the spoken name is played at step 496. If the user decides not to answer the call, at step 498, the call is sent to voice mail at step 500. In another embodiment the home gateway system just hangs up on the incoming call. If the user decides to answer the call, at step 498, that ends the process at step 502.

When the spoken name does belong to the set of preferred callers at step 494, it is determined if the spoken name belongs to an owner (set of owners) at step 504. When the spoken name does not belong to an owner, at step 504, or the incoming telephone number is part of the preferred telephone numbers, at step 486, the telephone is rung at step 506. When the telephone is answered at step 508, that ends the process at step 510. When the telephone is not answered within a predetermined time at step 508, the user is provided a number of options (plurality of options) at step 512. The options fall into two categories, leaving a voice mail, step 514, or control options at step 516. Before the caller is allowed access to the control options a speaker

verification process is performed at step 518. If the speaker cannot be verified, the process ends, step 510. In another embodiment, the user is asked to enter a PIN, if the system cannot verify their voice. When the speaker is verified, they are provided a number of control options at step 520. These options include controlling or monitoring the home security system at step 522, controlling or monitoring the home appliances, lights, etc. at step 524 or controlling the voice mail system at step 526.

FIG. 23 is a schematic diagram of a home gateway system for home automation and security in accordance with one embodiment of the invention. The home gateway system 20 is located inside a house 22. The home gateway system 20 has an input to receive a cable television 24 input signal. The home gateway system 20 is also connected by a wireless local loop 26 and a base station 28 to the public switch telephone network (PSTN) 30. The antenna 32 for the wireless local loop 26 is shown in the attic of the house. The PSTN 30 provides access to an internet service provider (ISP) 34, which provides access to the internet 36. A telephone 38, television 40, computer 42, printer 44 can all be connected to the home gateway system 20. In addition, appliances 45, lights 46 and sprinkling systems 47 can be connected to the home gateway system as part of the home automation features. A home security system 48 can also be connected to the home gateway system 20. This allows the home automation and security features to be integrated into the home communication system. For instance, the computer 42 can be used to setup times of day for the sprinkling system to turn on or the

computer can print a report of the activities of the appliances or the security systems.

FIG. 24 is a block diagram of a home gateway system 530 for home automation and security in accordance with one embodiment of the invention. The home gateway system 530 has a wireless local loop transceiver 532. A home automation controller 534 is capable of sending and receiving messages from the wireless local loop transceiver 532. A home security controller 536 is capable of sending and receiving messages from the wireless local loop transceiver 532.

FIG. 25 is a flow chart of the steps used in a home gateway system for home automation and security in accordance with one embodiment of the invention. The process starts, step 540, by receiving a request for access to a home automation and security features from a user at step 542. A speaker verification of the user is performed at step 544. When the user is verified, the user is allowed access to the home automation and security features at step 546. At step 548, a voiced instruction is received which ends the process at step 550.

In one embodiment, the step of receiving a request for access to the home automation and security features further includes inputting an electronic address of the home gateway system. Next, an electronic connection is established with the home gateway system. The user is then presented with a plurality of options including the home automation and security features. In one embodiment the step of entering the electronic address, is performed by dialing a phone number. In another

embodiment the electronic connection is a wireless local loop telephony connection.

In yet another embodiment the electronic connection is an internet connection and the user clicks on the home automation and security features option. The internet connection can be carried over the wireless local loop or over the cable TV link.

In one embodiment the speaker verification step further includes requesting a user to speak an access code. The access code is recognized using speech recognition. When the access code is valid and belongs to a set of approved access codes, a speaker verification is performed. When the speaker verification fails, the user is requested to enter a personal identification number. When the personal identification is valid, the user is allowed access to the home automation and security features. When the personal identification is not valid the user is denied access to the home automation and security features.

In a further embodiment the voiced instruction is recognized using the speech recognition system. The recognized instruction is converted into an electronic instruction that the home automation and security system can understand. The electronic instruction is then sent to the home automation and security controller.

FIG. 26 is a flow chart of the steps used in a home gateway system for home automation and security in accordance with another embodiment of the invention. The process starts, step 570, by monitoring a parameter at step 572. When the parameter exceeds a defined range, a message is sent containing an electronic address to a processor at step 574. A communication link to the electronic address is

established over a wireless local loop at step 576. At step 578 the message is transmitted to the electronic address, which ends the process at step 580.

In one embodiment the parameter is a forceful entry signal and the message contains a police telephone number. In another embodiment a portion of the message is speech synthesized to form an audio message. The audio message is transmitted to the electronic address. For instances, the audio message could include the street address of house and which sensor was tripped. In addition, the message could tell the police if the owners are home.

In another embodiment the message includes an internet address of the police. A message is sent to a police computer and includes the street address of house and which sensor was tripped. In yet another embodiment the parameters monitored can be an appliance. The data points for the parameter can be sent over the internet to the owner at a remote location. This would allow a homeowner to determine if a sprinkler was left on or the furnace had quit working.

FIGs. 27 & 28 are a flow chart of the steps used in a home gateway system for home automation and security in accordance with another embodiment of the invention. The process starts, step 590, by the user dialing a telephone number of the home gateway system at step 592. A wireless local loop connection is established with the home gateway step at step 594. The user then selects the home automation and security features from a plurality of options at step 596. A speaker verification is performed of the user at step 598.

When the user is verified, the user is allowed access to the home automation and security features at step 600. A voice instruction is received from the user to setup the home security controller in a warning mode at step 602. A forceful entry signal is monitored at step 604. When the forceful entry signal exceeds a defined range, a message containing a police telephone number is sent to a processor at step 606. A communication link to the police telephone number is established over wireless local loop at step 608. At step 610, the message is transmitted to the police telephone number, which ends the process at step 612.

Thus there has been described a home gateway system that integrates the information carrying needs of a home user. The home gateway system combines a full service voice answering and reception capability, with internal switched connections, a router for data communications products, a home automation and a security system and a television processing system. Using the home gateway system a user can easily place both standard and data telephone calls.

The methods described herein can be implemented as computer-readable instructions stored on a computer-readable storage medium that when executed by a computer will perform the methods described herein.

While the invention has been described in conjunction with specific embodiments thereof, it is evident that many alterations, modifications, and variations will be apparent to those skilled in the art in light of the foregoing description. For instance, the home gateway system is generally described with respect to a

wireless local loop, however the home gateway system can also be used with a standard wired local loop. Accordingly, it is intended to embrace all such alterations, modifications, and variations in the appended claims.

Claims

What is claimed is:

1. A method of operating a home gateway system comprising the steps of:

(a) connecting a telephone to a data telephony interface of the home gateway system;

(b) dialing a destination telephone number;

(c) triggering on a call request at a switch of the home gateway system and sending a query to a processor of the home gateway system;

(d) receiving a reply from the processor including a telephone number of an internet service provider;

(e) establishing a telephony connection with the internet service provider; and

(f) sending a message to the internet service provider including the destination telephone number.

2. The method of claim 1, further including the steps of:

(g) receiving an audio signal from the telephone;

(h) digitizing the audio signal to form a digitized signal;

(i) packetizing the digitized signal to form a plurality of outgoing packets; and

(j) transmitting the plurality of outgoing packets to the internet service provider.

3. The method of claim 2, further including the steps of:

(k) receiving a plurality of incoming packets from the internet service provider;

(l) converting the plurality of incoming packets into an incoming audio signal; and

(m) connecting the incoming audio signal to the telephone.

4. The method of claim 1, wherein step (e) further includes the steps of:

(e1) establishing a wireless local loop connection to a base station;

(e2) connecting the base station to the internet service provider.

5. The method of claim 2, wherein step (h) includes the step of compressing the digitized signal.

6. The method of claim 2, wherein step (j) further includes the steps of:

(j1) determining a priority of the plurality of outgoing data packets;

(j2) when the priority is low, storing the plurality of outgoing data packets until all of a high priority data packets have been transmitted.

7. A method of operating a home gateway system comprising the steps of:

(a) receiving a request;

(b) when the request is received at a router and requires an external connection, passing the request to a processor;

(c) sending a command to a transceiver to establish the external connection;

(d) establishing a wireless local loop connection to a base station; and

(e) establishing a telephony connection to a service provider.

8. The method of claim 7, wherein step (c) further includes to the steps of;

(c1) determining if the request includes an asymmetrical data service indicator;

(c2) when the request includes an asymmetrical data service indicator, establishing an asymmetrical data link with the base station.

9. The method of claim 7, further including the steps of:

(f) receiving a plurality of data packets for transmission over the external connection;

(g) determining a priority for the plurality of data packets;

(h) when the plurality of data packets have a low priority and a high priority data packets are received for transmission over the external connection, sending the high priority data packets before sending the plurality of data packets.

10. The method of claim 7, further including the steps of:

(f) receiving a plurality of data packets for transmission over the external connection;

(g) determining a priority for the plurality of data packets;

(h) when the plurality of data packets have a low priority and a high priority data packets are received for transmission over the external connection, compressing the plurality of data packets to form a plurality of compressed data packets;

(i) multiplexing the plurality of compressed data packets with the high priority data packets over the external connection.

11. The method of claim 7, further including the steps of:

(f) when the request is an information service provider request, determining if the request was from a television processing system;

(g) when the request was from the television processing system, sending a received information over a channel to a television.

12. The method of claim 7, further including the steps of:

(f) when the request is received at a switch, determining if the request is from a data telephony interface;

(g) when the request is from the data telephony interface, sending a query to the processor;

(h) receiving a reply from the processor including a telephone number of an internet phone service provider;

(i) establishing a telephony connection with the internet phone service provider; and

(j) sending a message to the internet phone service provider including a destination telephone number.

13. A home gateway system comprising:

a transceiver;

a switch connected to the transceiver;

a processor connected to the switch;

a router connected to the switch, the router receiving a data packet from an internal port with an external address, the router sending a request to the processor to establish a communication session with an internet service provider, the processor directing the transceiver to establish a telephony connection with the internet service provider.

14. The home gateway system of claim 13, wherein the transceiver establishes a wireless local loop connection to a base station as part of the telephony connection.

15. The home gateway system of claim 13, wherein the processor directs the transceiver to setup an asymmetric data channel.

16. The home gateway system of claim 13, further including a television processing system connected to the router.

17. The home gateway system of claim 16, wherein the television processing system receives a plurality of information from an internet information provider, the television processing system sending the plurality of information over a selected channel of a television.

18. The home gateway system of claim 17, wherein the television processing system receives an email request, the television processing system directing the processor to download an email to the television processing system, the television processing system sending the email over the selected channel of the television.

19. The home gateway system of claim 13, further including an emergency broadcast network receiver connected to the television processing system.

20. The home gateway system of claim 13, further including a voice mail system.

21. A home gateway system comprising:

a transceiver including a vocoder and a multiplexer;

a switch connected to the transceiver having a telephony input and a data telephony input;

a processor connected to the switch;

a router connected to the switch capable of routing data between a plurality of ports;

a television processing system connected to the router, the television processing system capable of receiving an information from the router and sending the information over a predetermined channel to a television for display;

an emergency broadcast system receiver connected to the television processing system; and

wherein the switch receives a destination address over the data telephony input and sends a query to the processor, the processor returns a response including an internet phone provider number, the switch passes the internet phone provider number to the transceiver, the transceiver establishes a telephony connection with an internet phone provider including a wireless local loop connection to a base station.

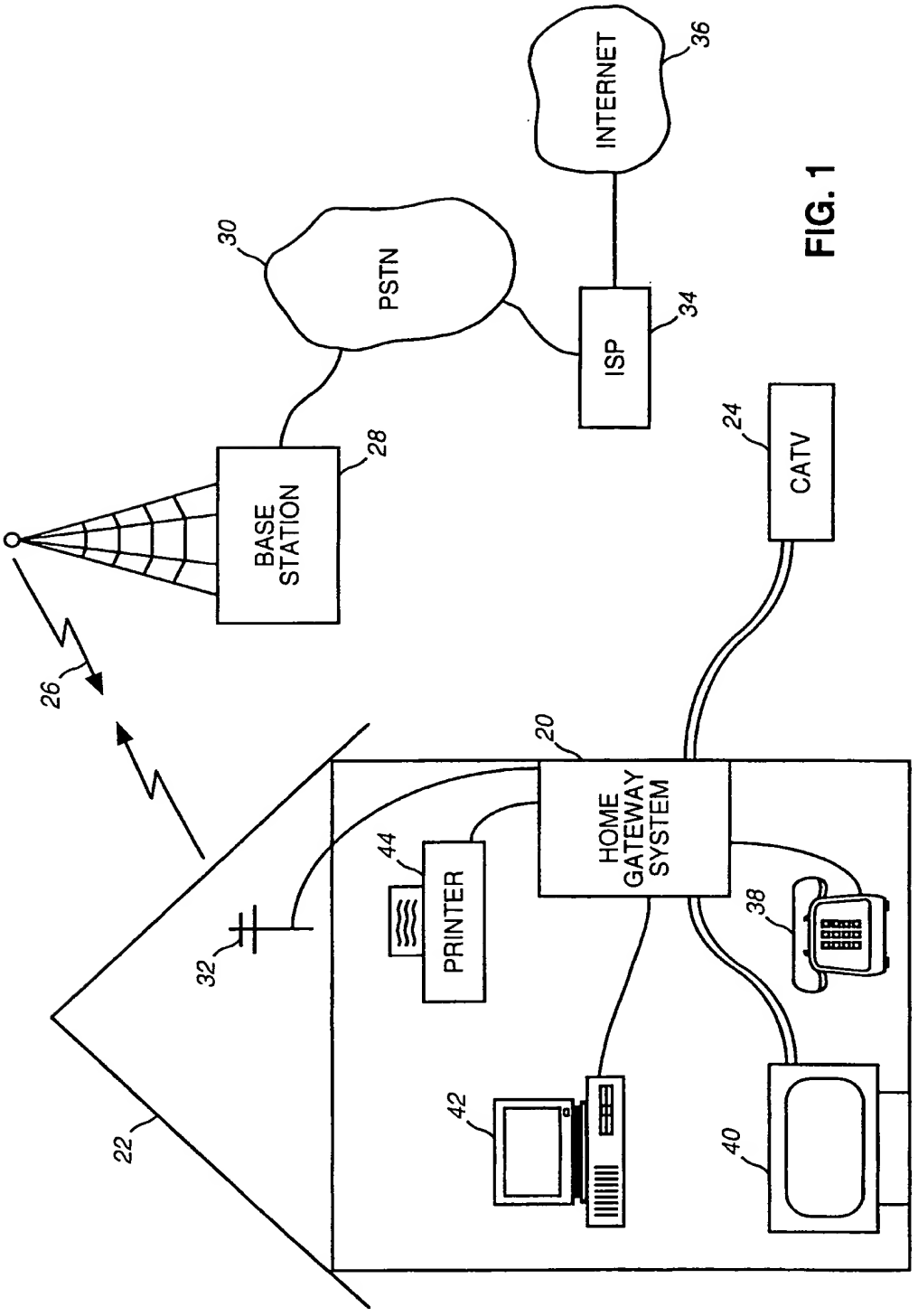
INTERNET
36
30
PSTN
ISP
34
BASE STATION
28
24
CATV
26
20
HOME GATEWAY SYSTEM
44
PRINTER
38
32
42
40
22

FIG. 1

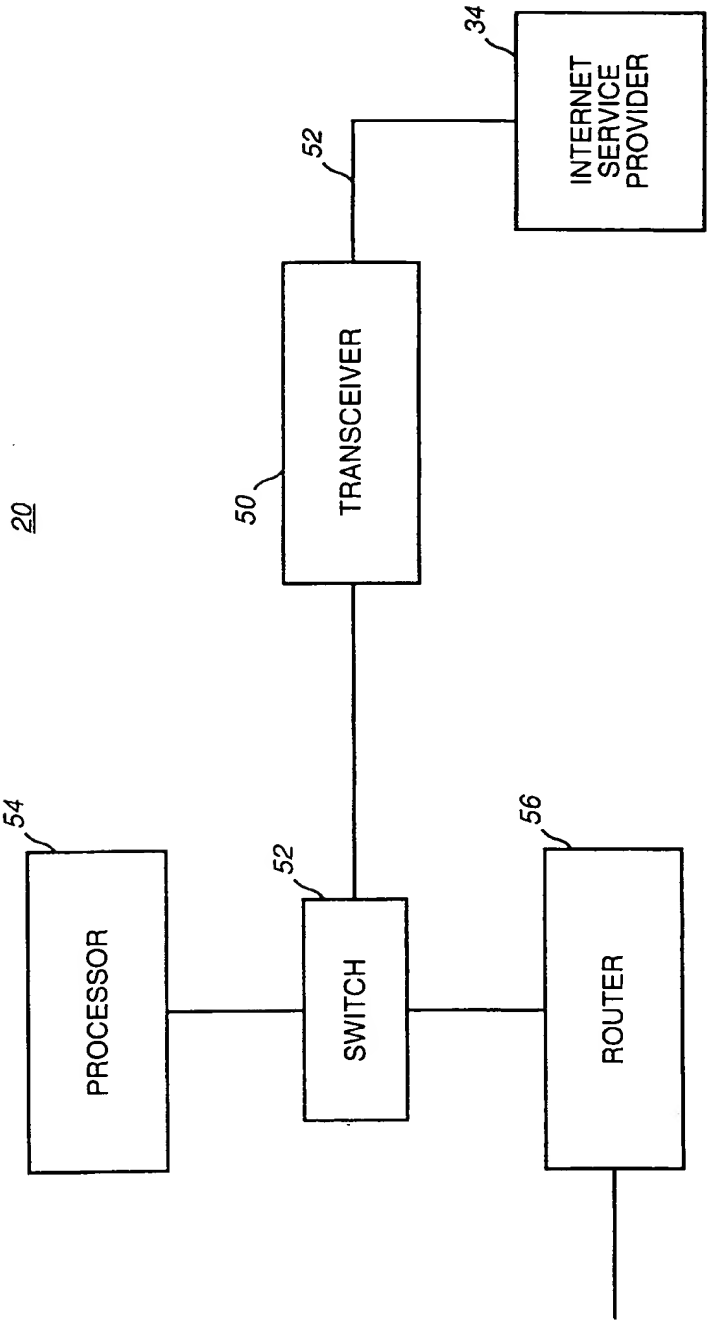
20
50
TRANSCEIVER
52
34
INTERNET SERVICE PROVIDER
54
PROCESSOR
52
SWITCH
56
ROUTER

FIG. 2

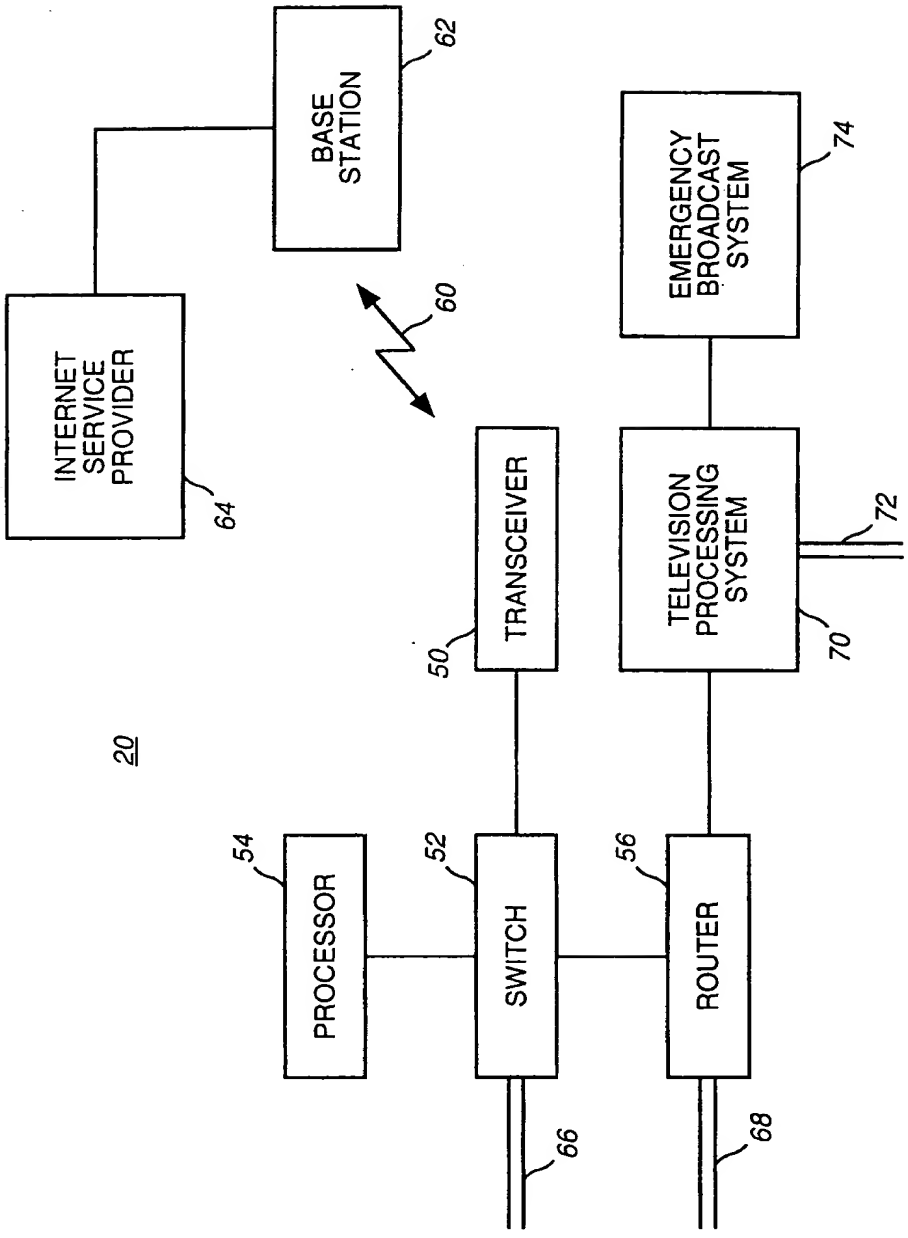
BASE STATION
62
EMERGENCY BROADCAST SYSTEM
74
60
INTERNET SERVICE PROVIDER
64
TRANSCEIVER
50
TELEVISION PROCESSING SYSTEM
72
70
20
54
PROCESSOR
52
SWITCH
56
ROUTER
66
68

FIG. 3

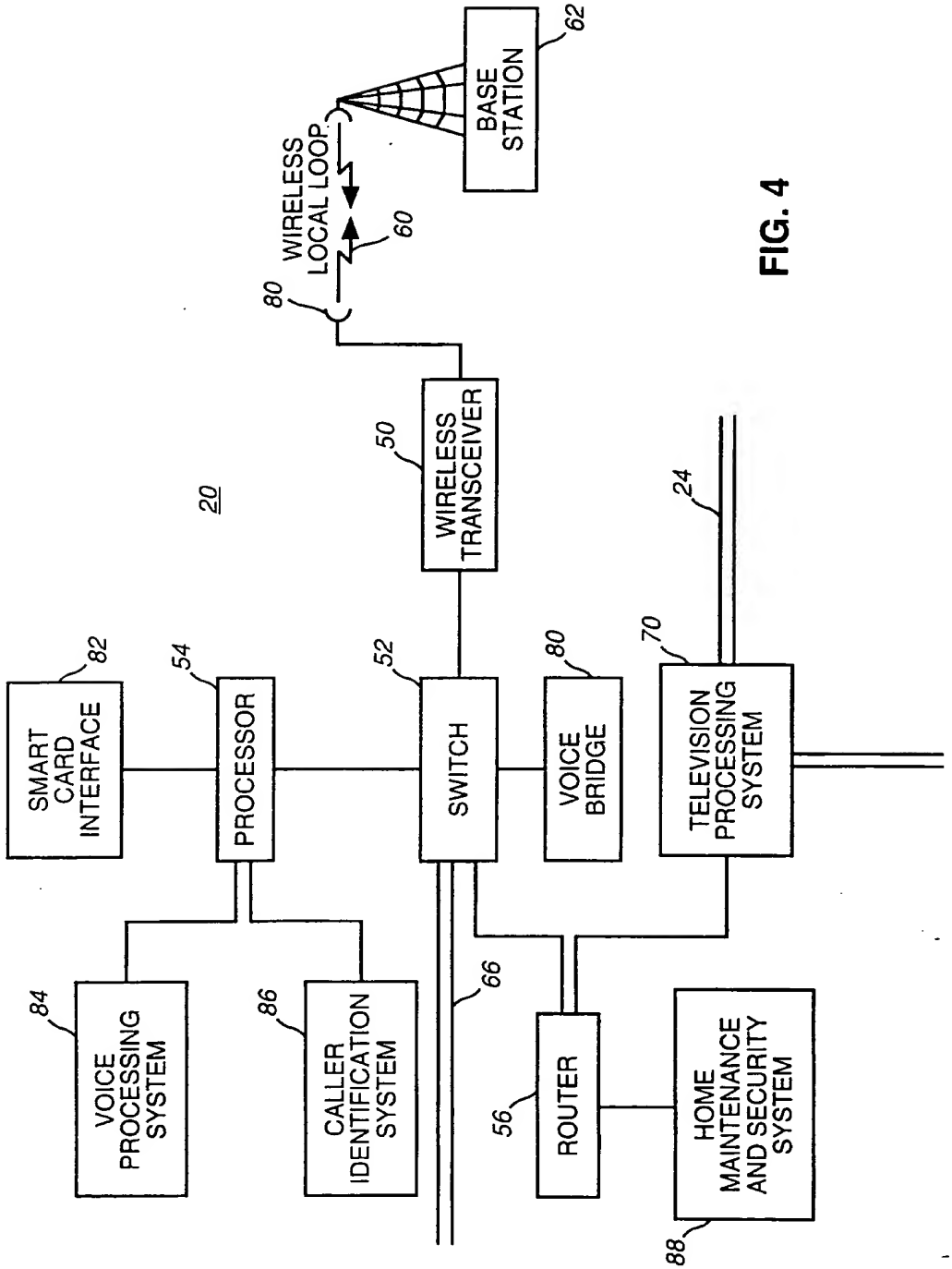
BASE STATION
62
WIRELESS LOCAL LOOP
60
80
WIRELESS TRANSCEIVER
50
20
24
SMART CARD INTERFACE
82
PROCESSOR
54
SWITCH
52
VOICE BRIDGE
80
TELEVISION PROCESSING SYSTEM
70
VOICE PROCESSING SYSTEM
84
CALLER IDENTIFICATION SYSTEM
86
66
ROUTER
56
HOME MAINTENANCE AND SECURITY SYSTEM
88

FIG. 4

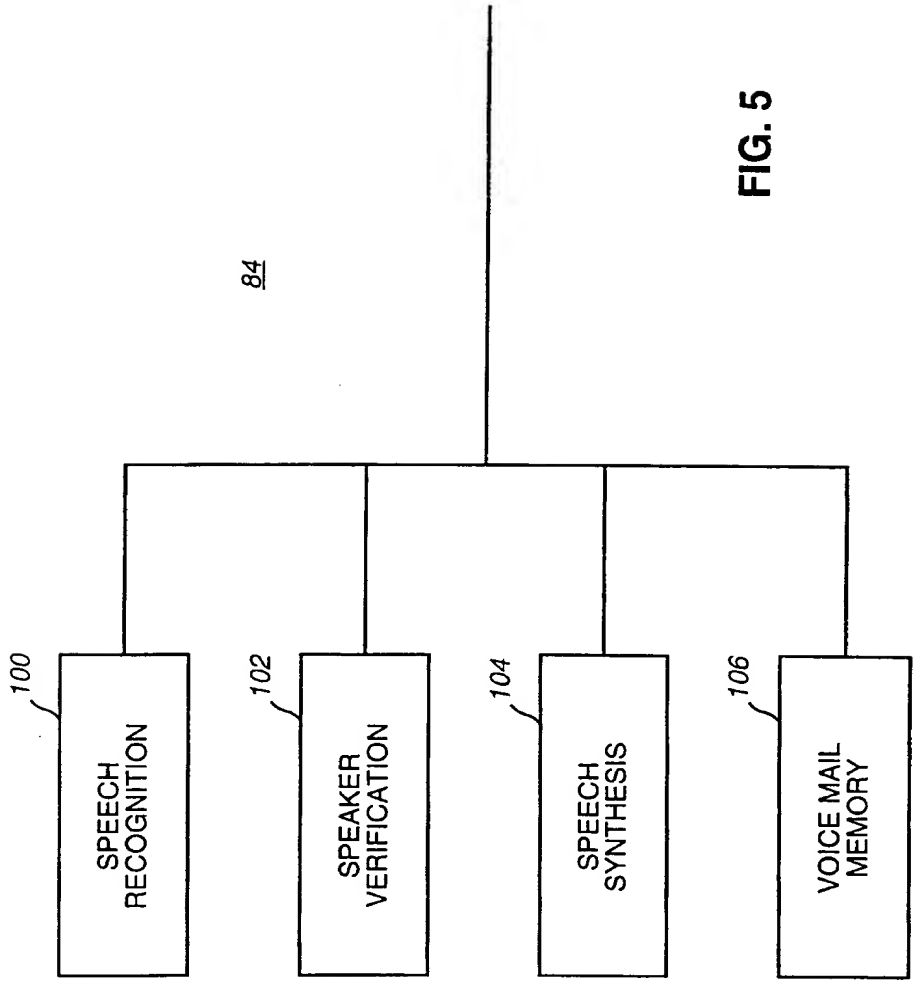
84
100
SPEECH RECOGNITION
102
SPEAKER VERIFICATION
104
SPEECH SYNTHESIS
106
VOICE MAIL MEMORY

FIG. 5

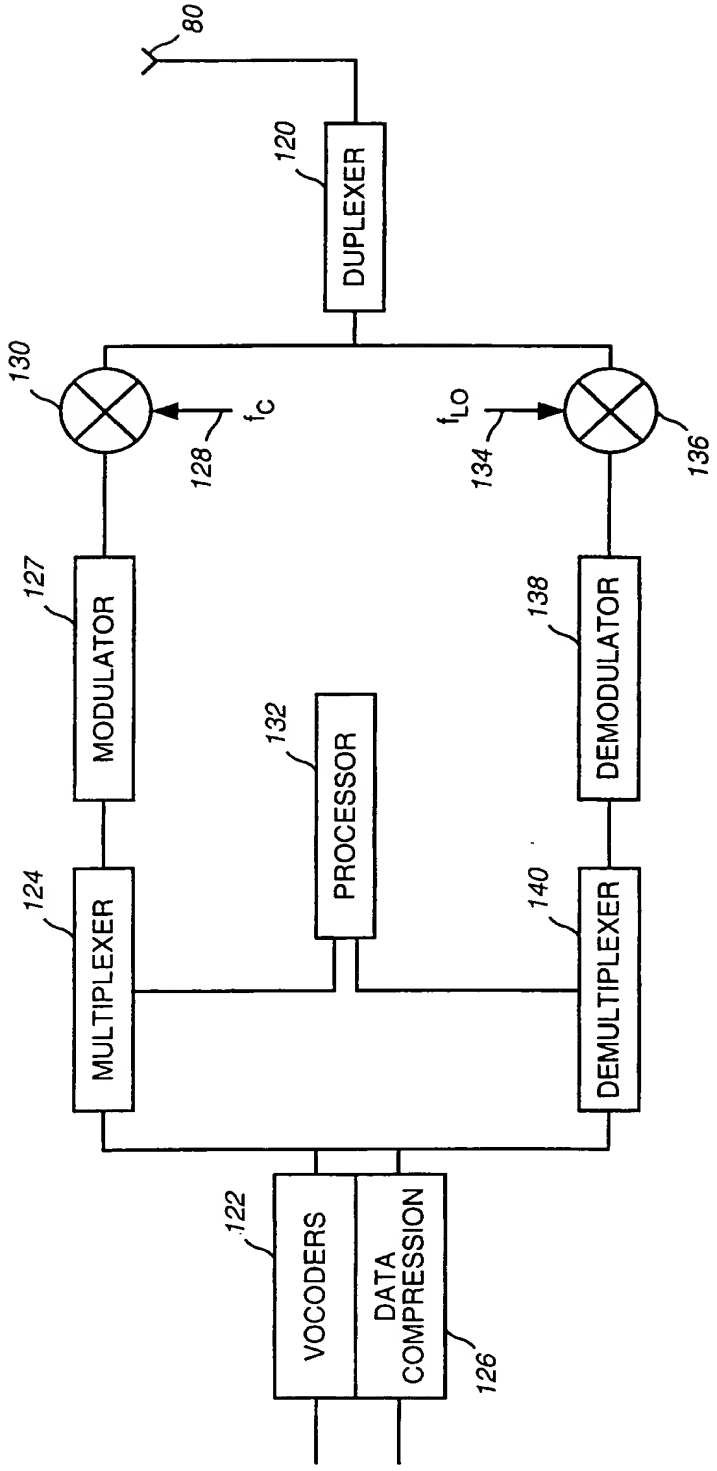
80
120
DUPLEXER
130
128
f_C
f_{LO}
134
136
127
MODULATOR
138
DEMODULATOR
132
PROCESSOR
124
MULTIPLEXER
140
DEMULTIPLEXER
122
VOCODERS
DATA COMPRESSION
126

FIG. 6

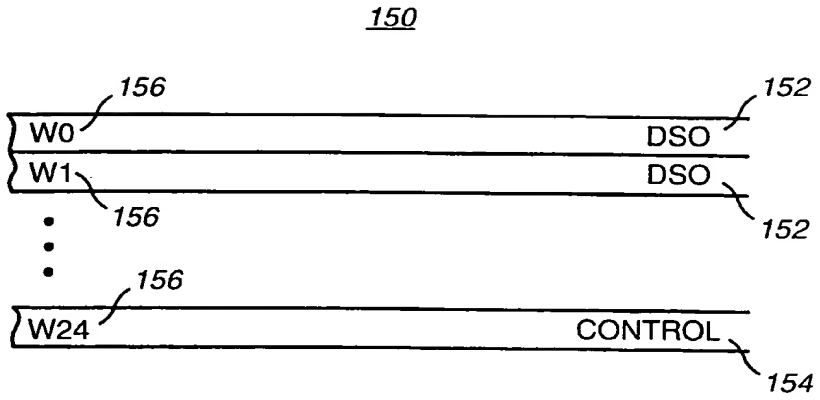
150
156
152
W0
DSO
W1
DSO
156
152
156
W24
CONTROL
154

FIG. 7

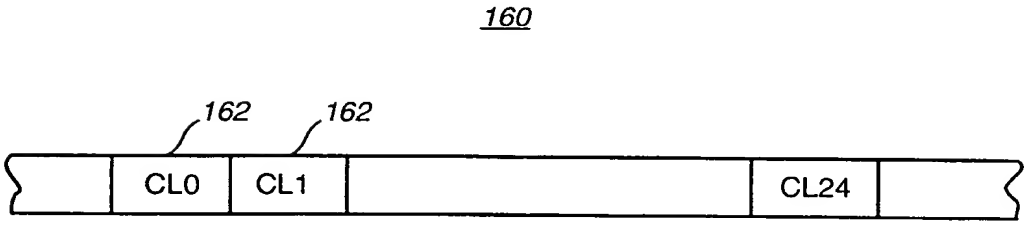
160
162
162
CL0
CL1
CL24

FIG. 8

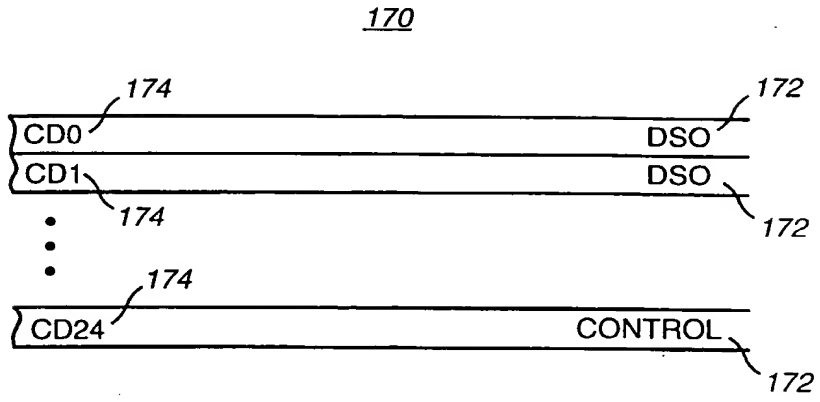
170
174
172
CD0
DSO
CD1
DSO
174
172
174
CD24
CONTROL
172

FIG. 9

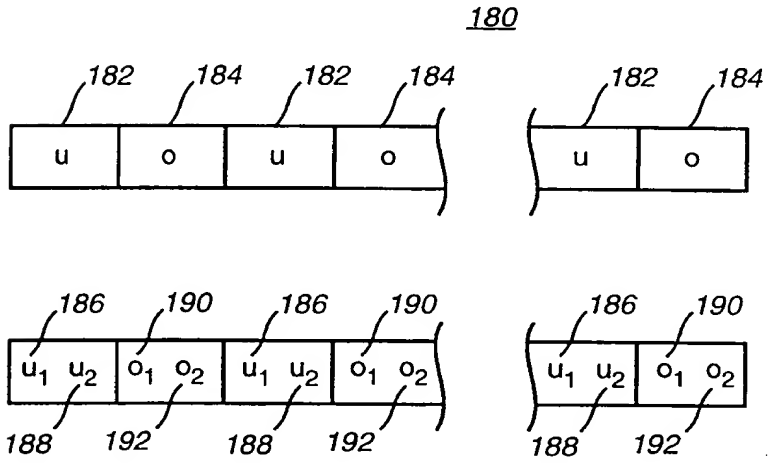
180
182
184
182
184
182
184
u
o
u
o
u
o
186
190
186
190
186
190
u_1 u_2
o_1 o_2
u_1 u_2
o_1 o_2
u_1 u_2
o_1 o_2
188
192
188
192
188
192

FIG. 10

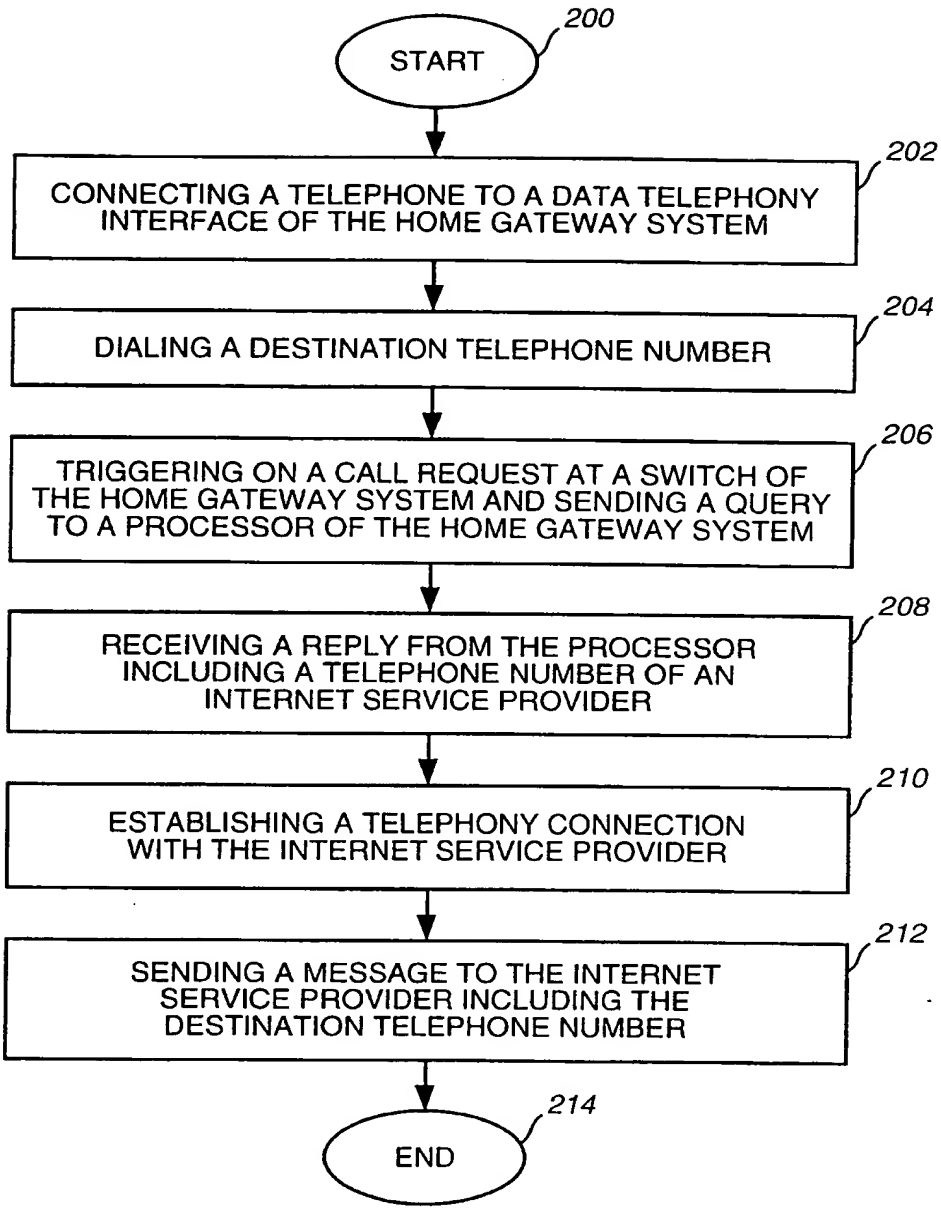
200
START
202
CONNECTING A TELEPHONE TO A DATA TELEPHONY INTERFACE OF THE HOME GATEWAY SYSTEM
204
DIALING A DESTINATION TELEPHONE NUMBER
206
TRIGGERING ON A CALL REQUEST AT A SWITCH OF THE HOME GATEWAY SYSTEM AND SENDING A QUERY TO A PROCESSOR OF THE HOME GATEWAY SYSTEM
208
RECEIVING A REPLY FROM THE PROCESSOR INCLUDING A TELEPHONE NUMBER OF AN INTERNET SERVICE PROVIDER
210
ESTABLISHING A TELEPHONY CONNECTION WITH THE INTERNET SERVICE PROVIDER
212
SENDING A MESSAGE TO THE INTERNET SERVICE PROVIDER INCLUDING THE DESTINATION TELEPHONE NUMBER
214
END

FIG. 11

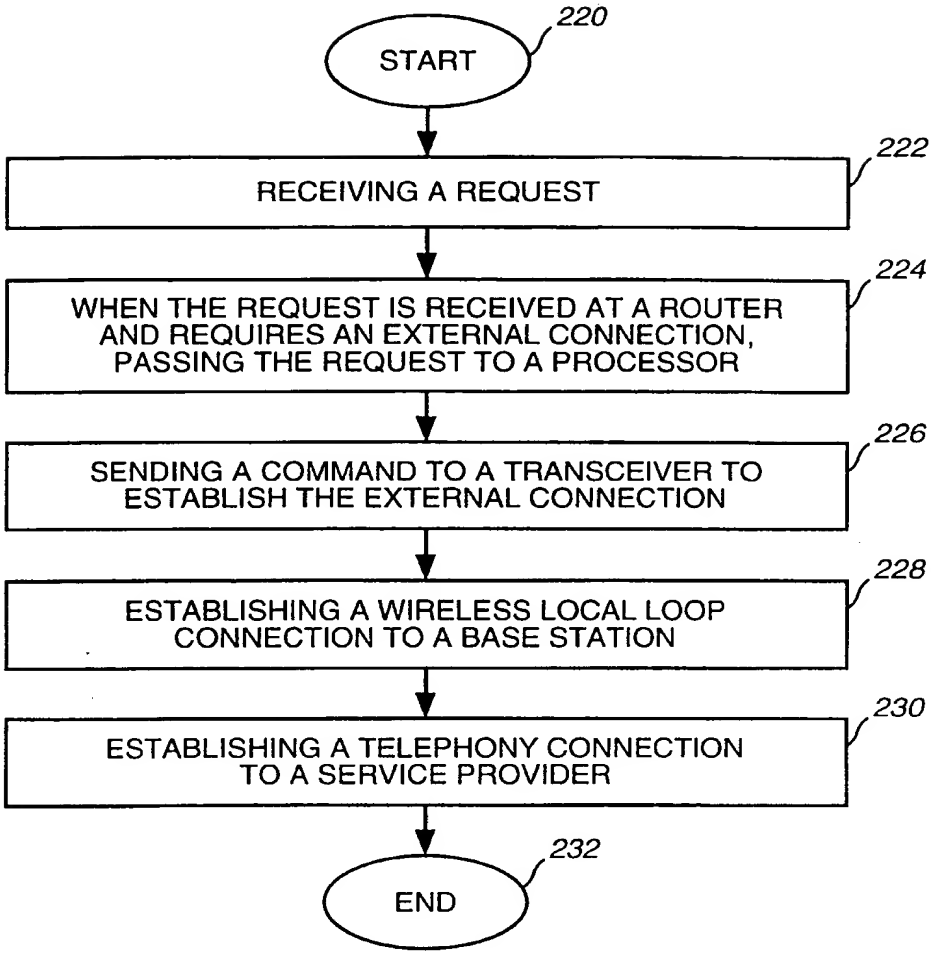
220
START
222
RECEIVING A REQUEST
224
WHEN THE REQUEST IS RECEIVED AT A ROUTER AND REQUIRES AN EXTERNAL CONNECTION, PASSING THE REQUEST TO A PROCESSOR
226
SENDING A COMMAND TO A TRANSCEIVER TO ESTABLISH THE EXTERNAL CONNECTION
228
ESTABLISHING A WIRELESS LOCAL LOOP CONNECTION TO A BASE STATION
230
ESTABLISHING A TELEPHONY CONNECTION TO A SERVICE PROVIDER
232
END

FIG. 12

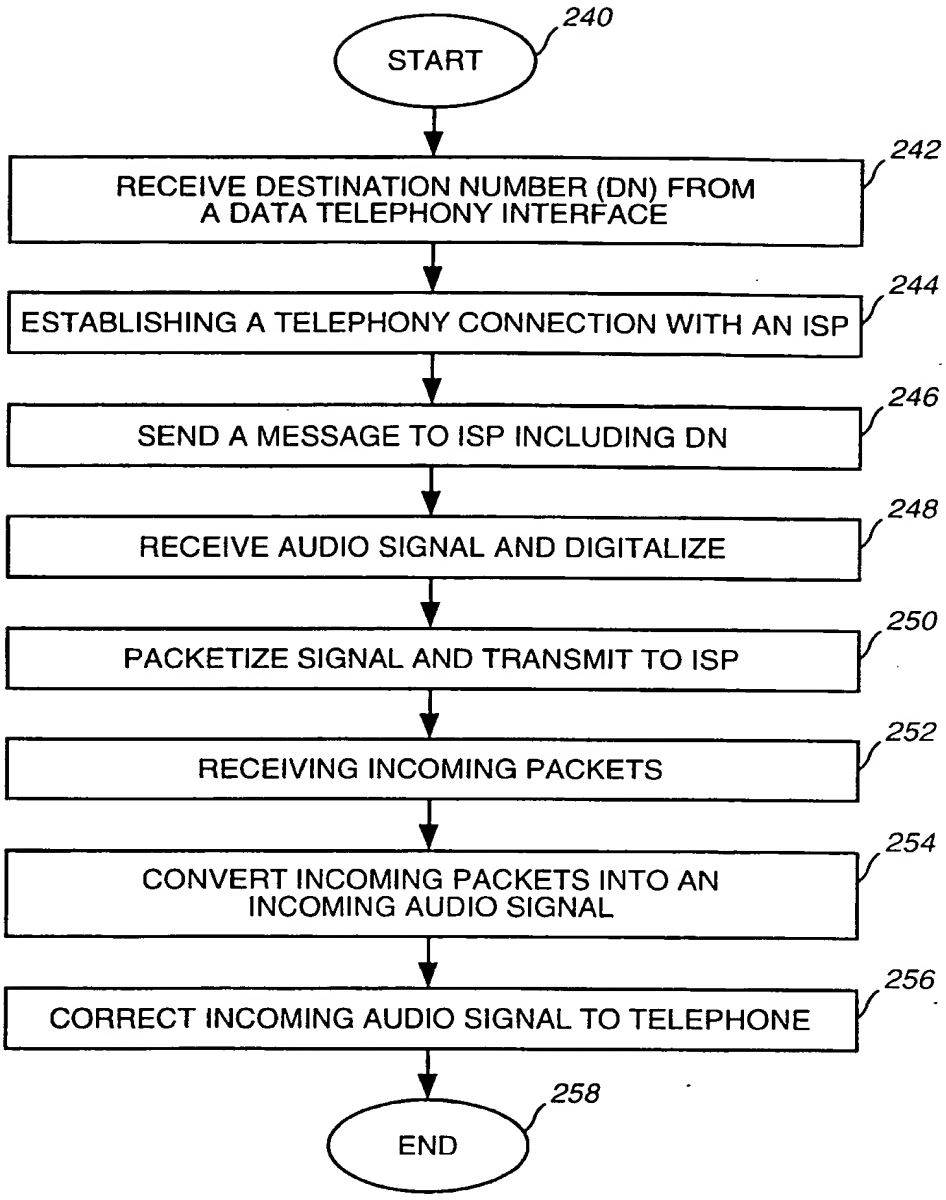
240
START
242
RECEIVE DESTINATION NUMBER (DN) FROM A DATA TELEPHONY INTERFACE
244
ESTABLISHING A TELEPHONY CONNECTION WITH AN ISP
246
SEND A MESSAGE TO ISP INCLUDING DN
248
RECEIVE AUDIO SIGNAL AND DIGITALIZE
250
PACKETIZE SIGNAL AND TRANSMIT TO ISP
252
RECEIVING INCOMING PACKETS
254
CONVERT INCOMING PACKETS INTO AN INCOMING AUDIO SIGNAL
256
CORRECT INCOMING AUDIO SIGNAL TO TELEPHONE
258
END

FIG. 13

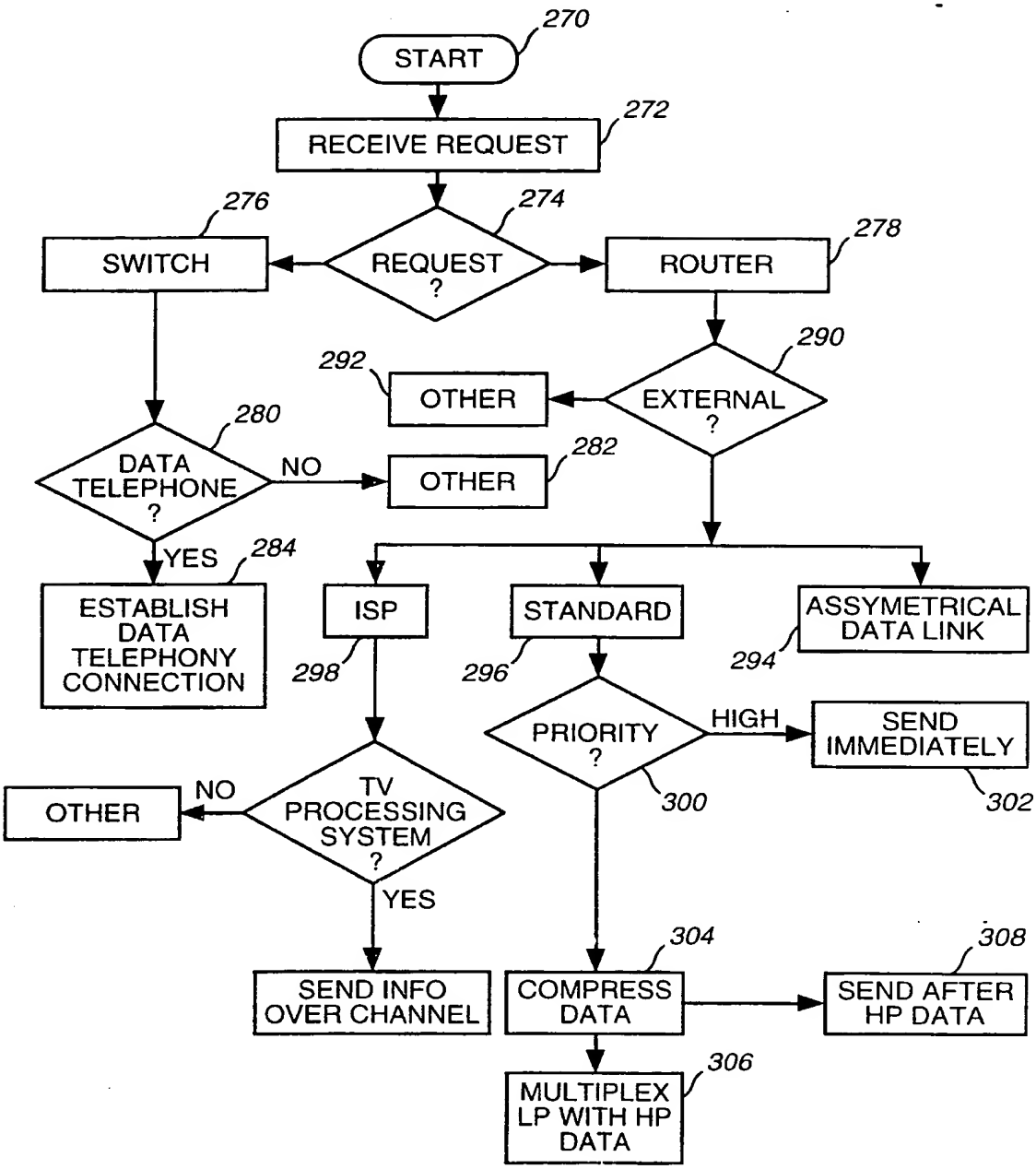
270
START
272
RECEIVE REQUEST
276
274
278
SWITCH
REQUEST ?
ROUTER
290
292
OTHER
EXTERNAL ?
280
282
DATA TELEPHONE ?
NO
OTHER
YES
284
ESTABLISH DATA TELEPHONY CONNECTION
ISP
STANDARD
ASSYMETRICAL DATA LINK
298
296
294
PRIORITY ?
HIGH
SEND IMMEDIATELY
300
302
NO
OTHER
TV PROCESSING SYSTEM ?
YES
304
308
SEND INFO OVER CHANNEL
COMPRESS DATA
SEND AFTER HP DATA
306
MULTIPLEX LP WITH HP DATA

FIG. 14

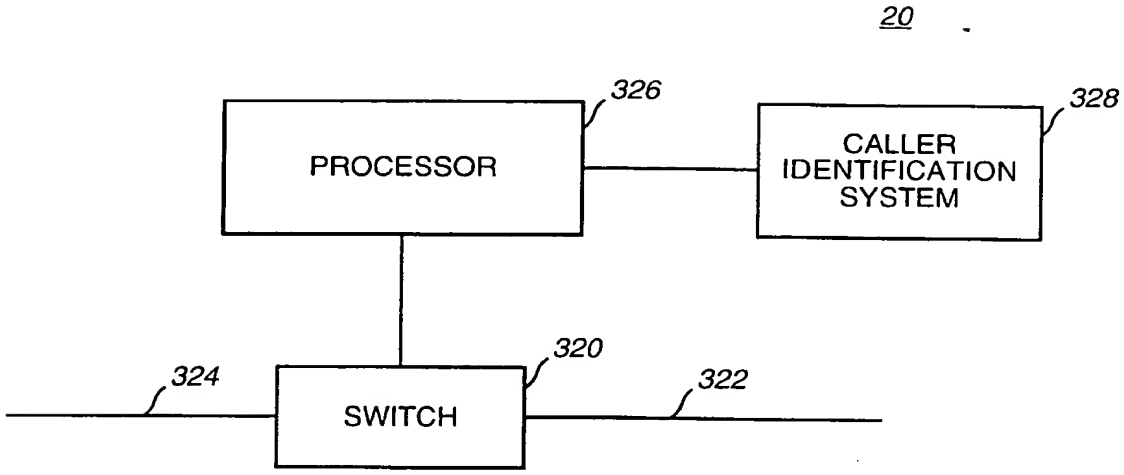
20
326
328
PROCESSOR
CALLER IDENTIFICATION SYSTEM
320
324
322
SWITCH

FIG. 15

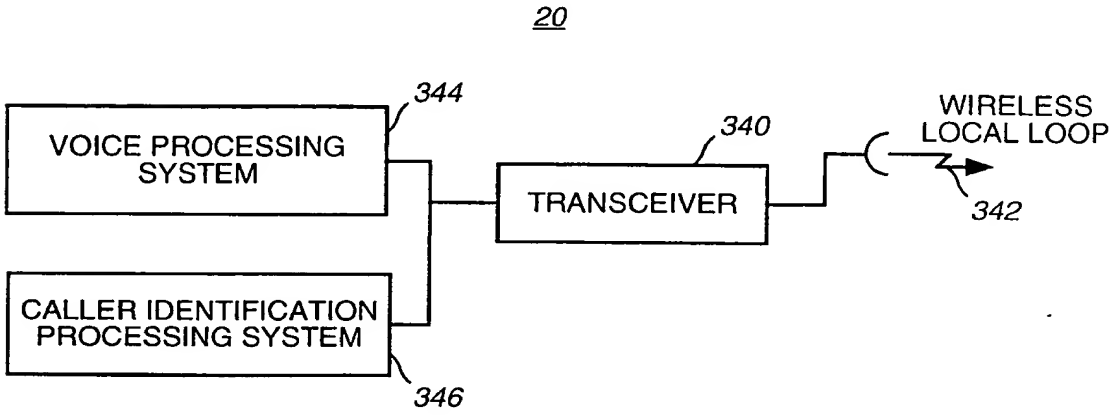
20
344
340
WIRELESS LOCAL LOOP
VOICE PROCESSING SYSTEM
TRANSCEIVER
342
CALLER IDENTIFICATION PROCESSING SYSTEM
346

FIG. 16

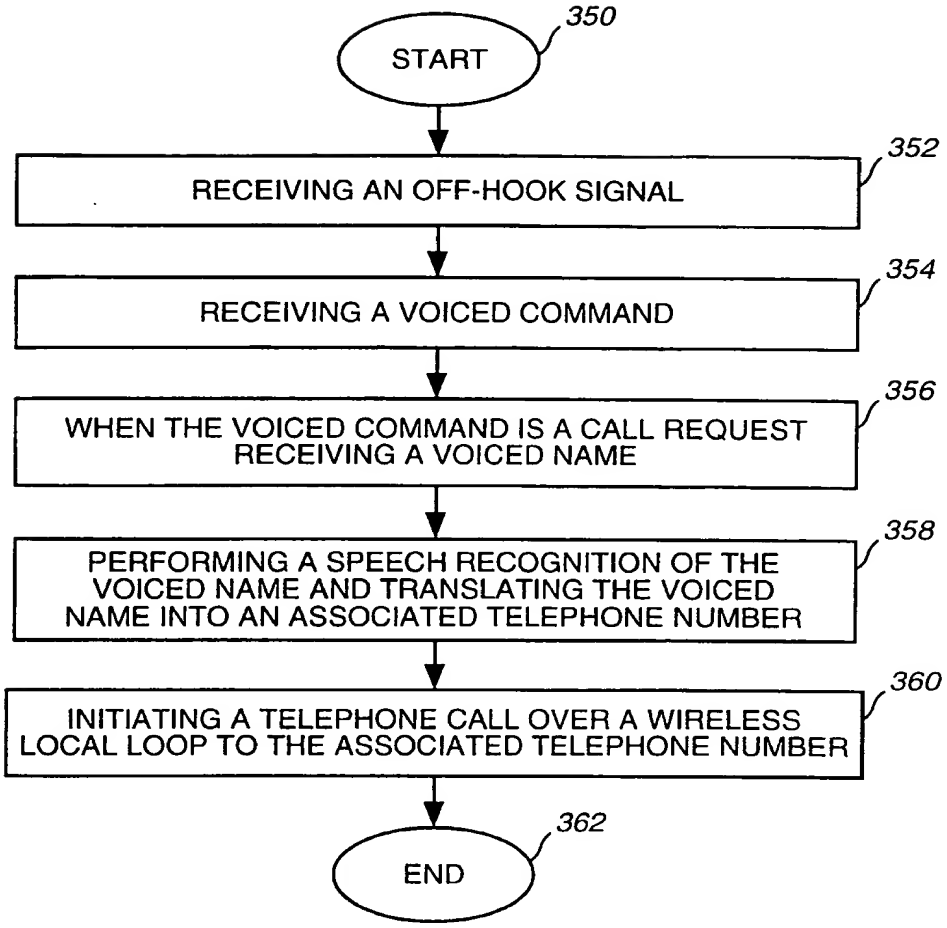
350
START
352
RECEIVING AN OFF-HOOK SIGNAL
354
RECEIVING A VOICED COMMAND
356
WHEN THE VOICED COMMAND IS A CALL REQUEST RECEIVING A VOICED NAME
358
PERFORMING A SPEECH RECOGNITION OF THE VOICED NAME AND TRANSLATING THE VOICED NAME INTO AN ASSOCIATED TELEPHONE NUMBER
360
INITIATING A TELEPHONE CALL OVER A WIRELESS LOCAL LOOP TO THE ASSOCIATED TELEPHONE NUMBER
362
END

FIG. 17

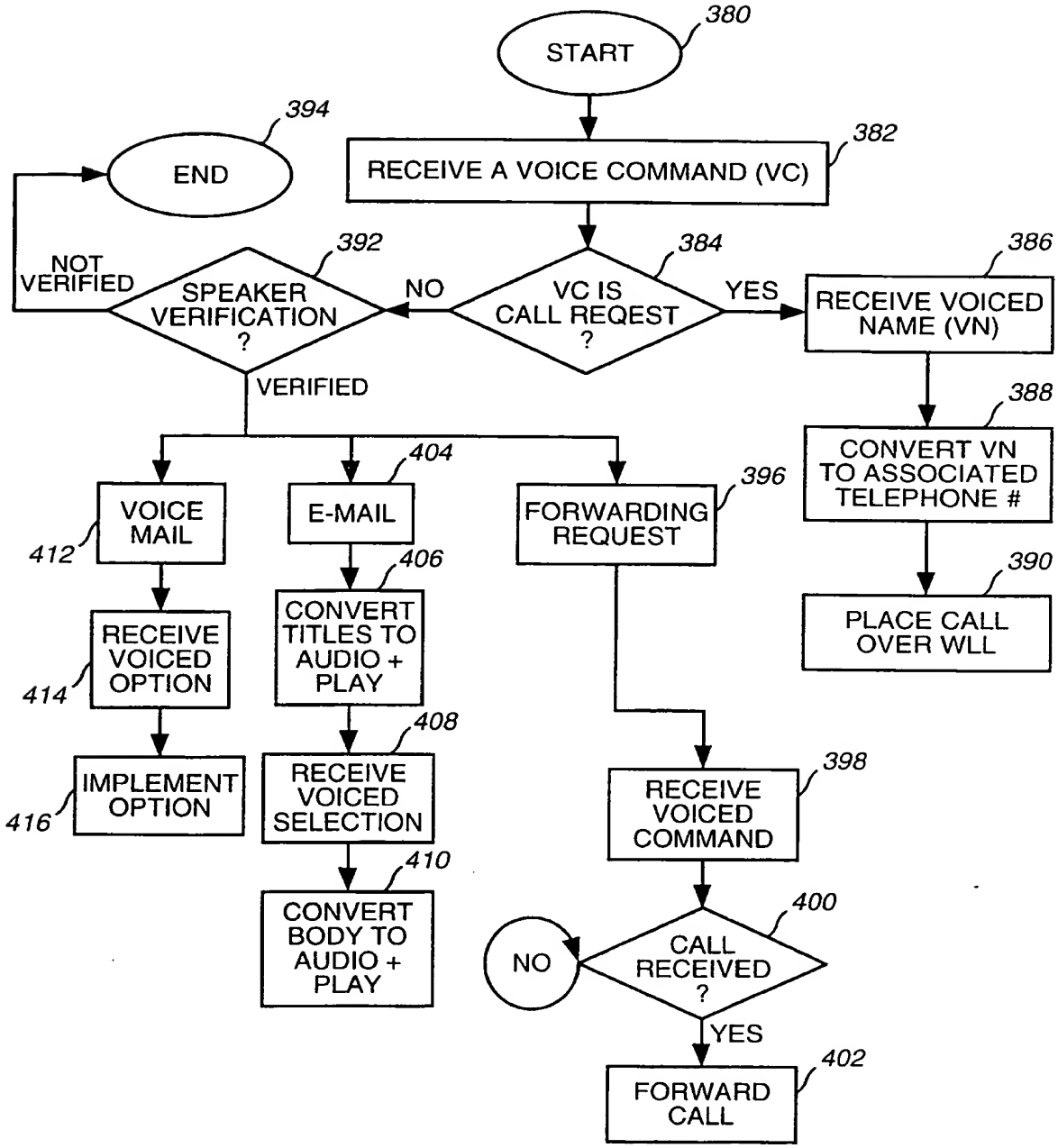
START
380
RECEIVE A VOICE COMMAND (VC)
382
VC IS CALL REQEST ?
384
YES
RECEIVE VOICED NAME (VN)
386
CONVERT VN TO ASSOCIATED TELEPHONE #
388
PLACE CALL OVER WLL
390
NO
SPEAKER VERIFICATION ?
392
NOT VERIFIED
END
394
VERIFIED
FORWARDING REQUEST
396
RECEIVE VOICED COMMAND
398
CALL RECEIVED ?
400
NO
YES
FORWARD CALL
402
E-MAIL
404
CONVERT TITLES TO AUDIO + PLAY
406
RECEIVE VOICED SELECTION
408
CONVERT BODY TO AUDIO + PLAY
410
VOICE MAIL
412
RECEIVE VOICED OPTION
414
IMPLEMENT OPTION
416

FIG. 18

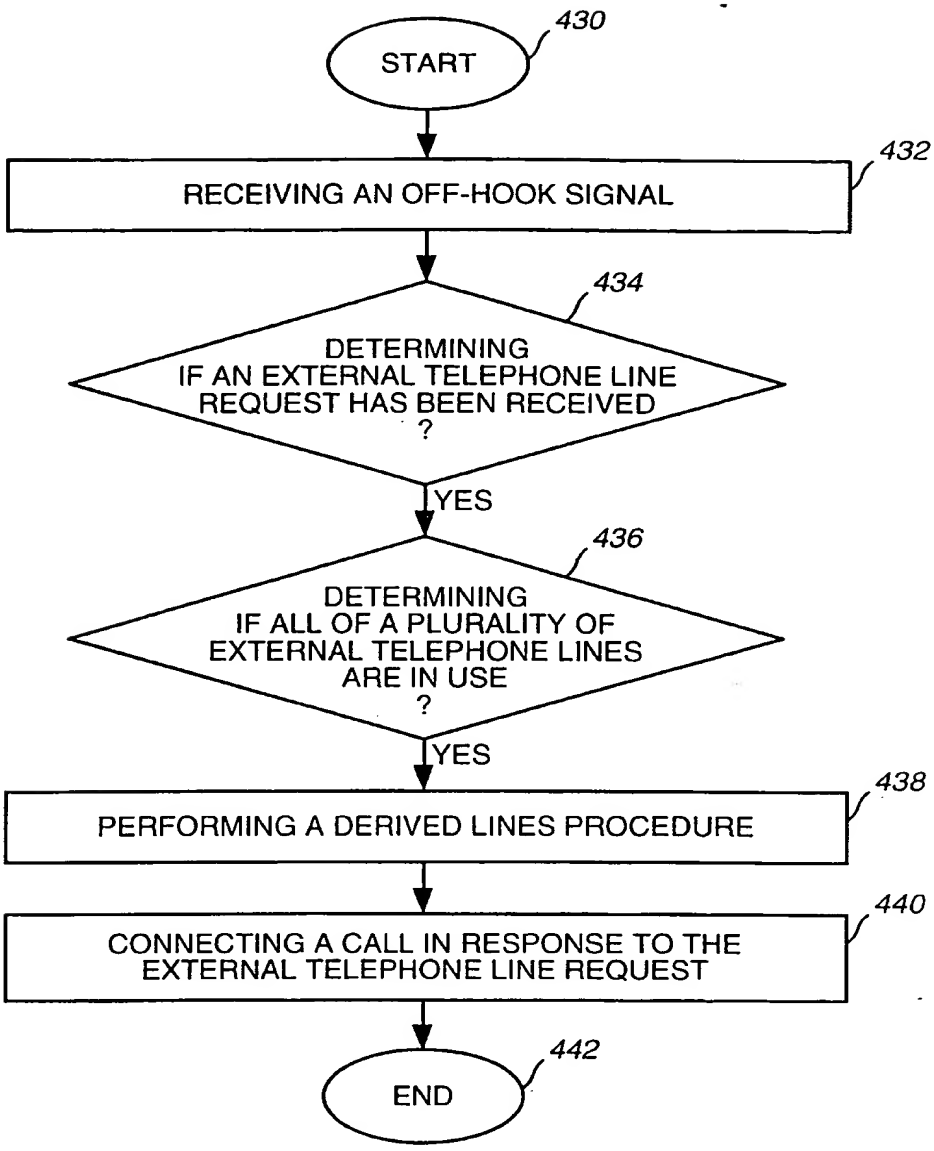
430
START
432
RECEIVING AN OFF-HOOK SIGNAL
434
DETERMINING IF AN EXTERNAL TELEPHONE LINE REQUEST HAS BEEN RECEIVED ?
YES
436
DETERMINING IF ALL OF A PLURALITY OF EXTERNAL TELEPHONE LINES ARE IN USE ?
YES
438
PERFORMING A DERIVED LINES PROCEDURE
440
CONNECTING A CALL IN RESPONSE TO THE EXTERNAL TELEPHONE LINE REQUEST
442
END

FIG. 19

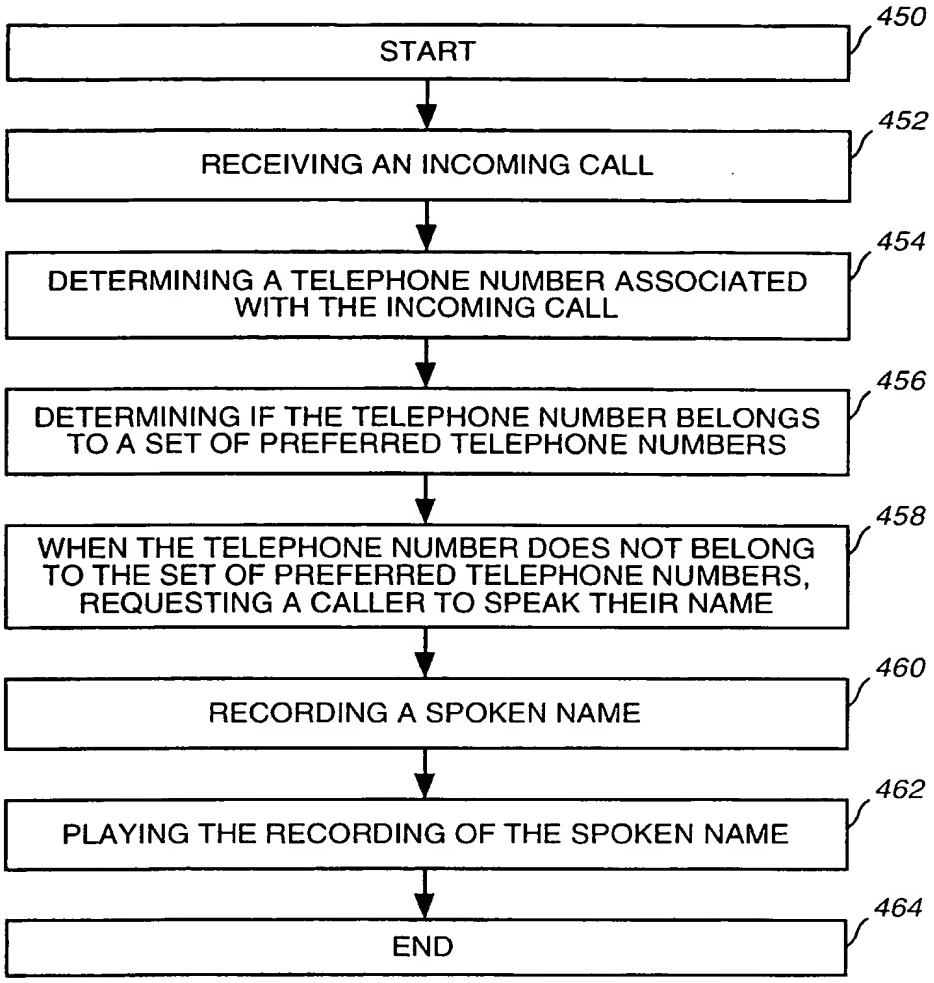
START
450
RECEIVING AN INCOMING CALL
452
DETERMINING A TELEPHONE NUMBER ASSOCIATED WITH THE INCOMING CALL
454
DETERMINING IF THE TELEPHONE NUMBER BELONGS TO A SET OF PREFERRED TELEPHONE NUMBERS
456
WHEN THE TELEPHONE NUMBER DOES NOT BELONG TO THE SET OF PREFERRED TELEPHONE NUMBERS, REQUESTING A CALLER TO SPEAK THEIR NAME
458
RECORDING A SPOKEN NAME
460
PLAYING THE RECORDING OF THE SPOKEN NAME
462
END
464

FIG. 20

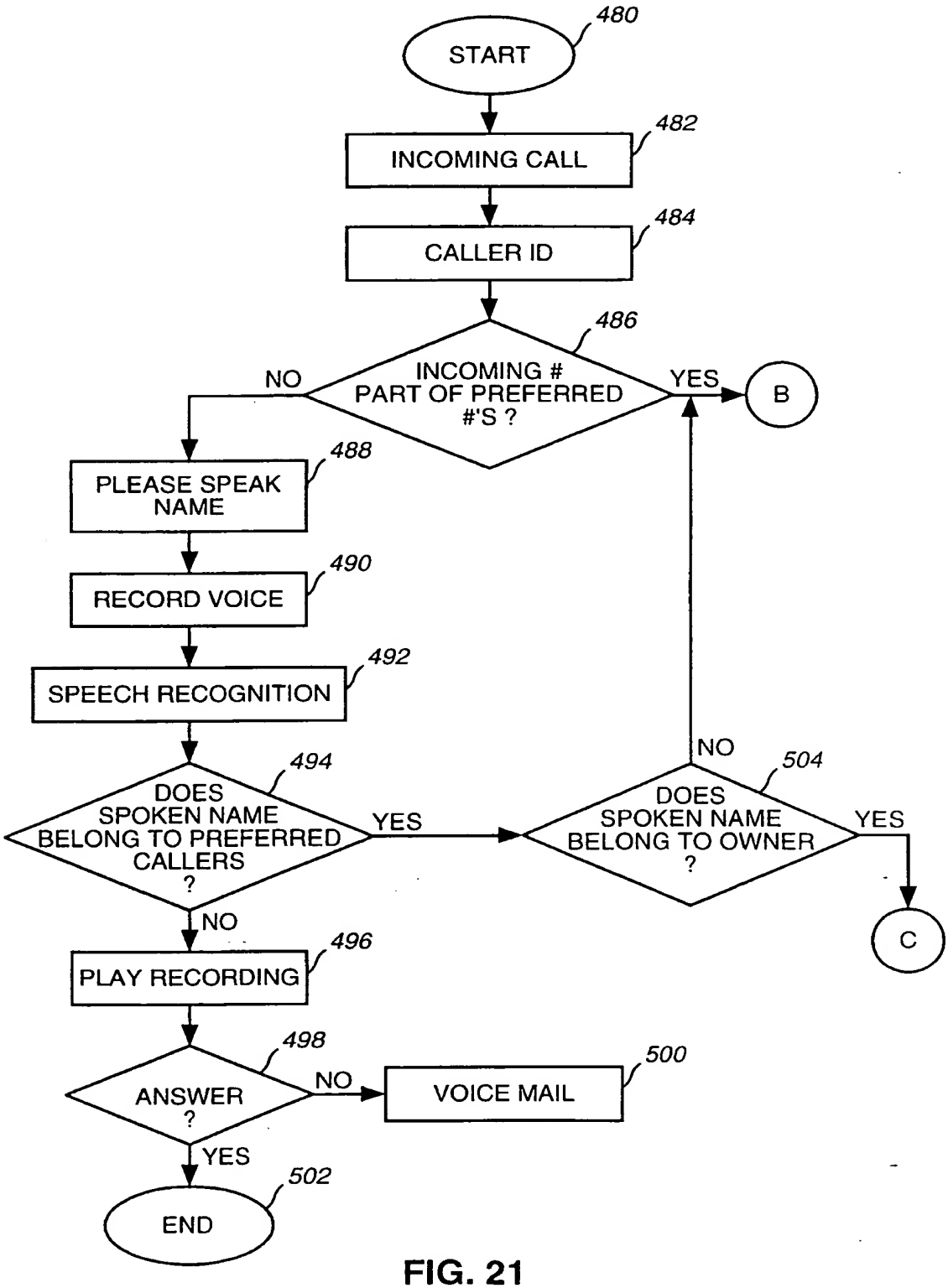
480
START
482
INCOMING CALL
484
CALLER ID
486
INCOMING # PART OF PREFERRED #'S ?
NO
YES
B
488
PLEASE SPEAK NAME
490
RECORD VOICE
492
SPEECH RECOGNITION
494
DOES SPOKEN NAME BELONG TO PREFERRED CALLERS ?
YES
NO
504
DOES SPOKEN NAME BELONG TO OWNER ?
NO
YES
C
496
PLAY RECORDING
498
ANSWER ?
NO
500
VOICE MAIL
YES
502
END

FIG. 21

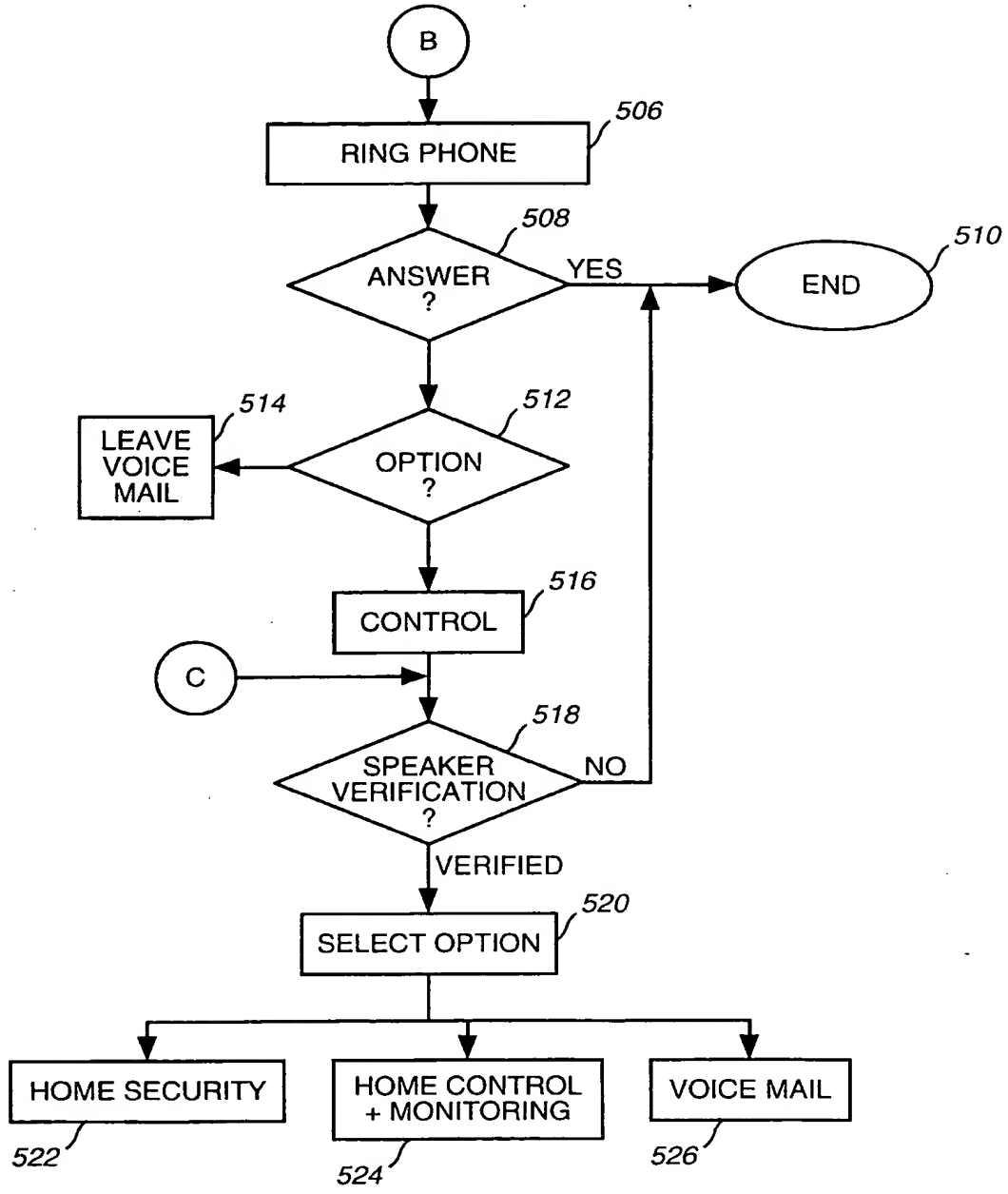
B
RING PHONE
506
ANSWER ?
508
YES
END
510
LEAVE VOICE MAIL
514
OPTION ?
512
CONTROL
516
C
SPEAKER VERIFICATION ?
518
NO
VERIFIED
SELECT OPTION
520
HOME SECURITY
522
HOME CONTROL + MONITORING
524
VOICE MAIL
526

FIG. 22

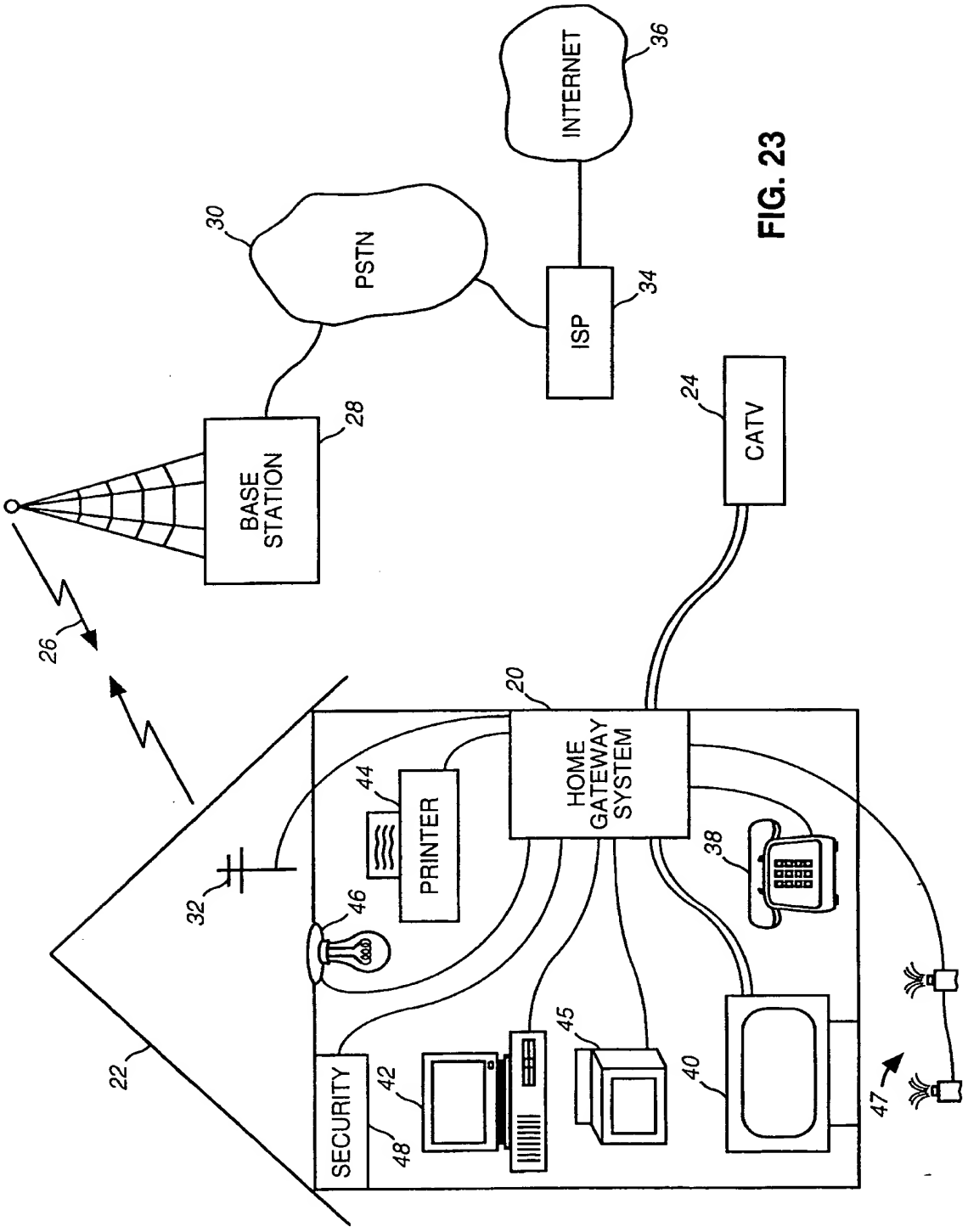
INTERNET
36
PSTN
30
ISP
34
BASE STATION
28
CATV
24
26
20
HOME GATEWAY SYSTEM
PRINTER
44
32
46
38
45
40
22
SECURITY
42
48
47

FIG. 23

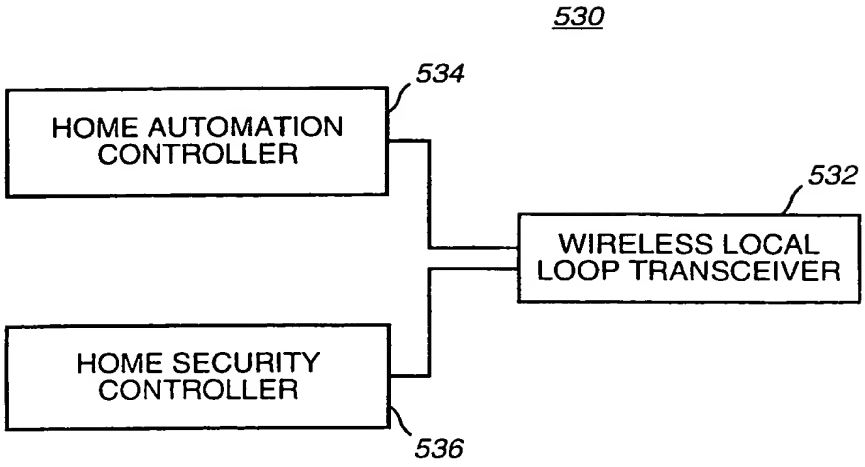
530
534
HOME AUTOMATION CONTROLLER
532
WIRELESS LOCAL LOOP TRANSCEIVER
HOME SECURITY CONTROLLER
536

FIG. 24

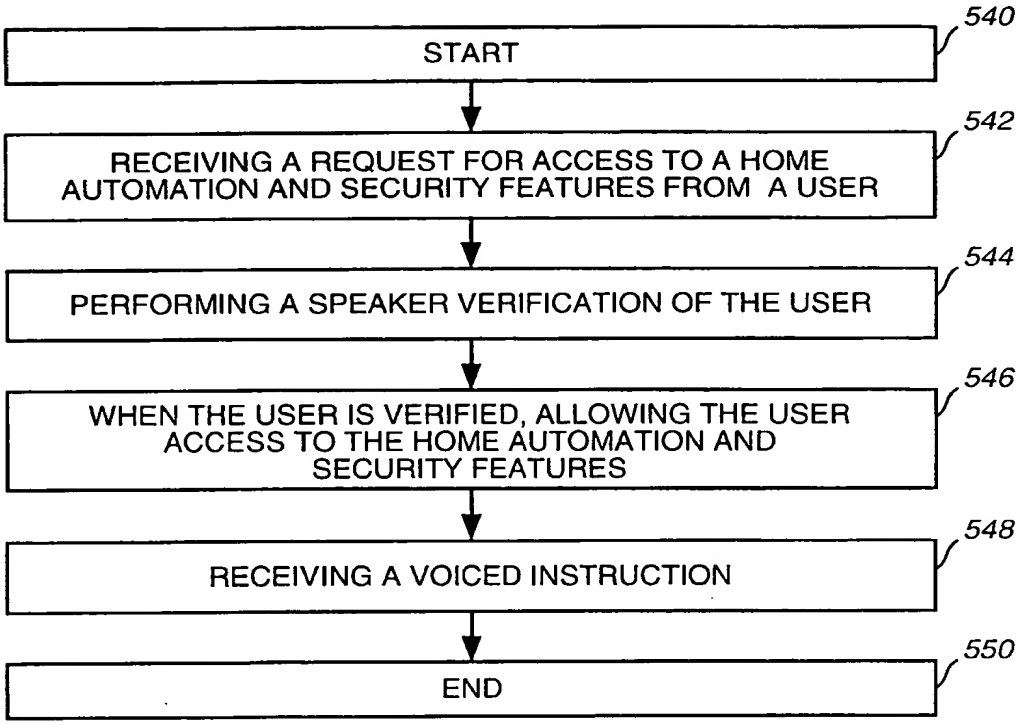
START
540
RECEIVING A REQUEST FOR ACCESS TO A HOME AUTOMATION AND SECURITY FEATURES FROM A USER
542
PERFORMING A SPEAKER VERIFICATION OF THE USER
544
WHEN THE USER IS VERIFIED, ALLOWING THE USER ACCESS TO THE HOME AUTOMATION AND SECURITY FEATURES
546
RECEIVING A VOICED INSTRUCTION
548
END
550

FIG. 25

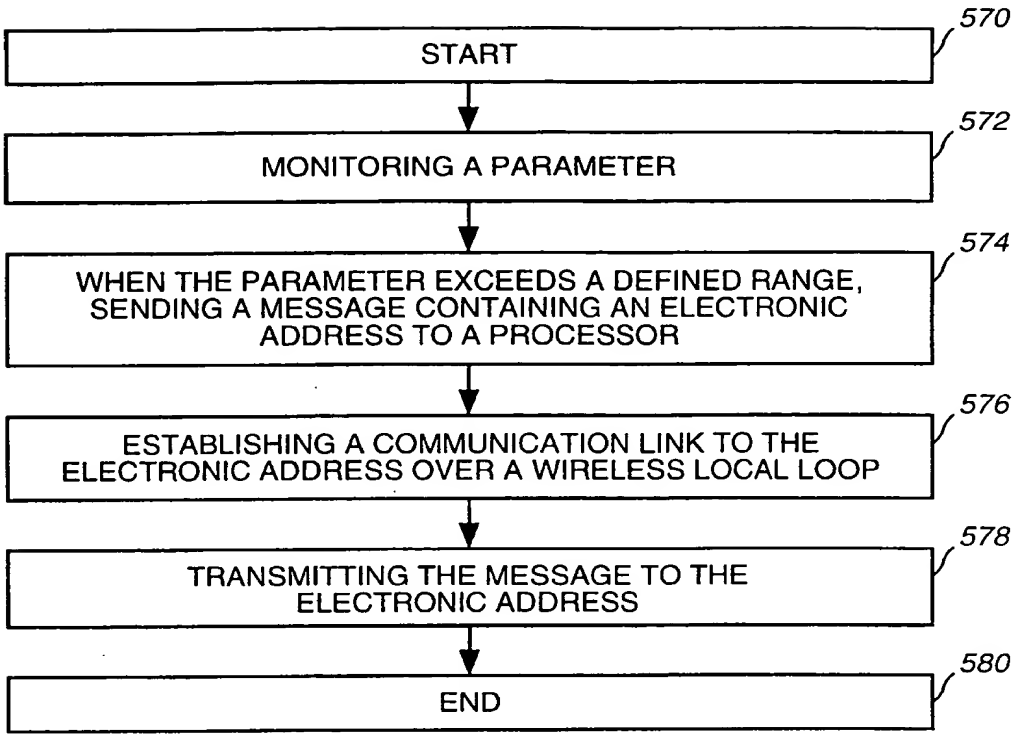
START
570
MONITORING A PARAMETER
572
WHEN THE PARAMETER EXCEEDS A DEFINED RANGE, SENDING A MESSAGE CONTAINING AN ELECTRONIC ADDRESS TO A PROCESSOR
574
ESTABLISHING A COMMUNICATION LINK TO THE ELECTRONIC ADDRESS OVER A WIRELESS LOCAL LOOP
576
TRANSMITTING THE MESSAGE TO THE ELECTRONIC ADDRESS
578
END
580

FIG. 26

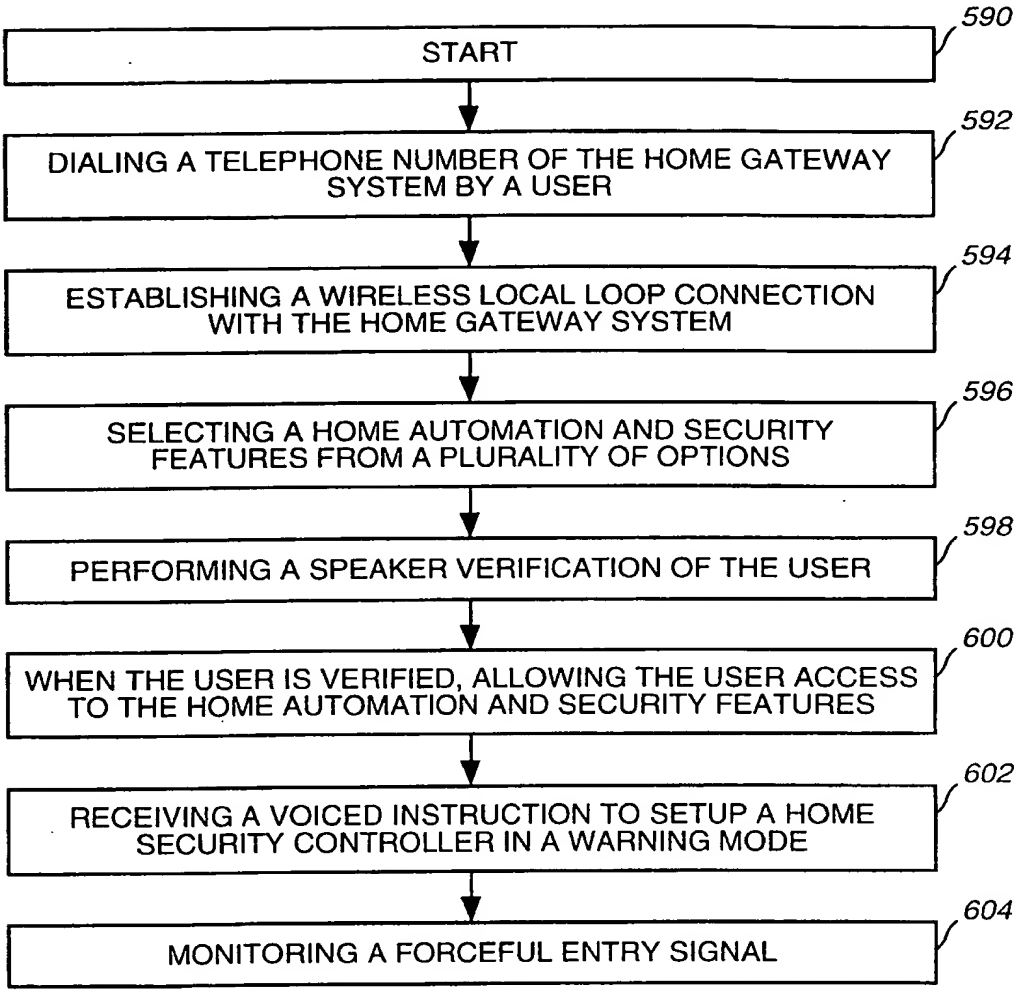
START
590
DIALING A TELEPHONE NUMBER OF THE HOME GATEWAY SYSTEM BY A USER
592
ESTABLISHING A WIRELESS LOCAL LOOP CONNECTION WITH THE HOME GATEWAY SYSTEM
594
SELECTING A HOME AUTOMATION AND SECURITY FEATURES FROM A PLURALITY OF OPTIONS
596
PERFORMING A SPEAKER VERIFICATION OF THE USER
598
WHEN THE USER IS VERIFIED, ALLOWING THE USER ACCESS TO THE HOME AUTOMATION AND SECURITY FEATURES
600
RECEIVING A VOICED INSTRUCTION TO SETUP A HOME SECURITY CONTROLLER IN A WARNING MODE
602
MONITORING A FORCEFUL ENTRY SIGNAL
604

FIG. 27

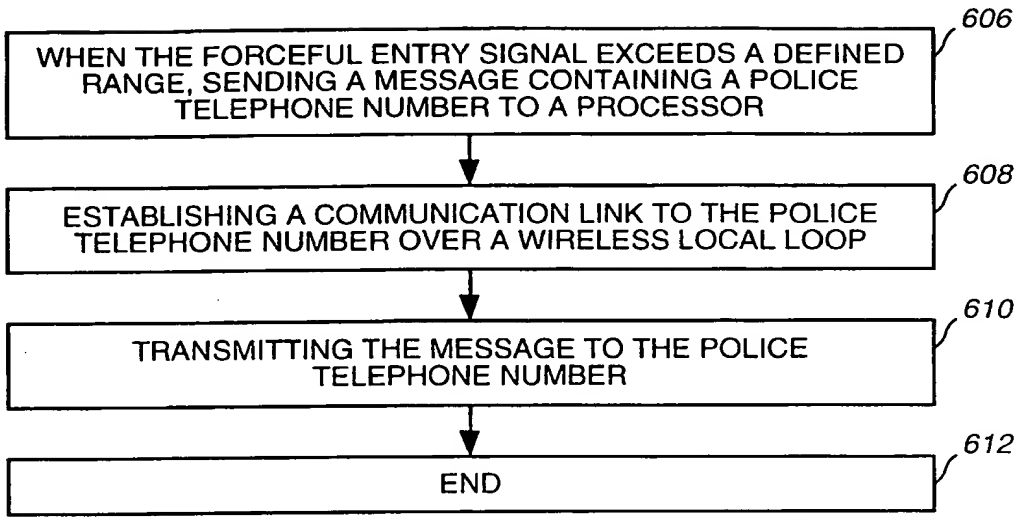
606
WHEN THE FORCEFUL ENTRY SIGNAL EXCEEDS A DEFINED RANGE, SENDING A MESSAGE CONTAINING A POLICE TELEPHONE NUMBER TO A PROCESSOR
608
ESTABLISHING A COMMUNICATION LINK TO THE POLICE TELEPHONE NUMBER OVER A WIRELESS LOCAL LOOP
610
TRANSMITTING THE MESSAGE TO THE POLICE TELEPHONE NUMBER
612
END

FIG. 28

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/08024

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :H04L 12/46
US CL : 370/401,410

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 370/401,410,352-356

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

internet, APS
gateway, internet, telephone

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,636,211 A (NEWLIN et al) 03 June 1997, fig. 1 and 4.	1-21
Y,P	US 5,862,203 A (WULKAN et al) 19 January 1999, abstract.	1-21
Y	US 5,724,355 A (BRUNO et al) 03 March 1998, fig. 2.	1-21
Y	US 5,737,333 A (CIVANLAR et al) 07 April 1998, fig. 2.	1-21

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 09 JUNE 1999	Date of mailing of the international search report 24 JUN 1999
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer JASPER KWOH Telephone No. (703) 305-3900

Form PCT/ISA/210 (second sheet)(July 1992)*